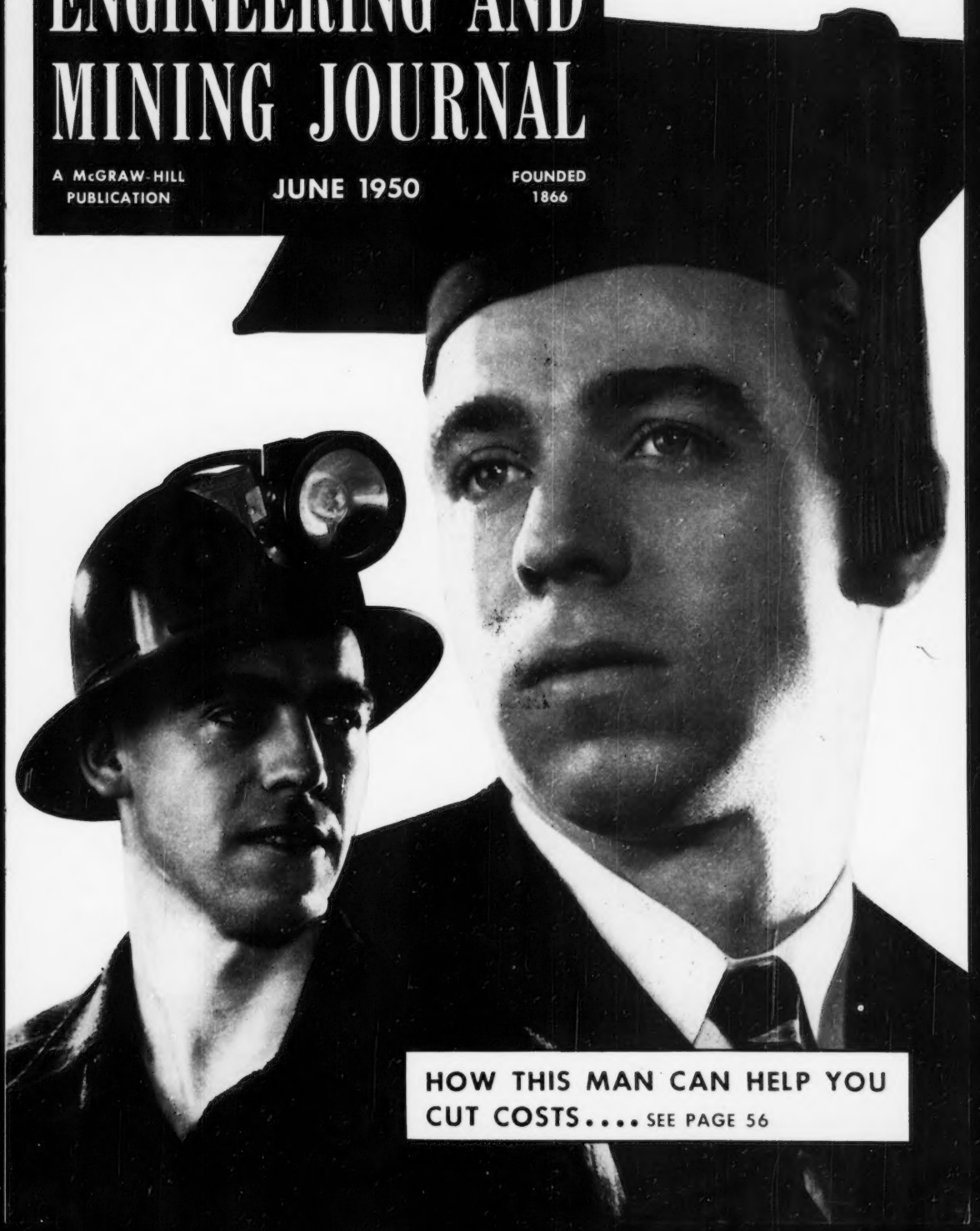
ENGINEERING AND MINING JOURNAL

A McGRAW-HILL PUBLICATION

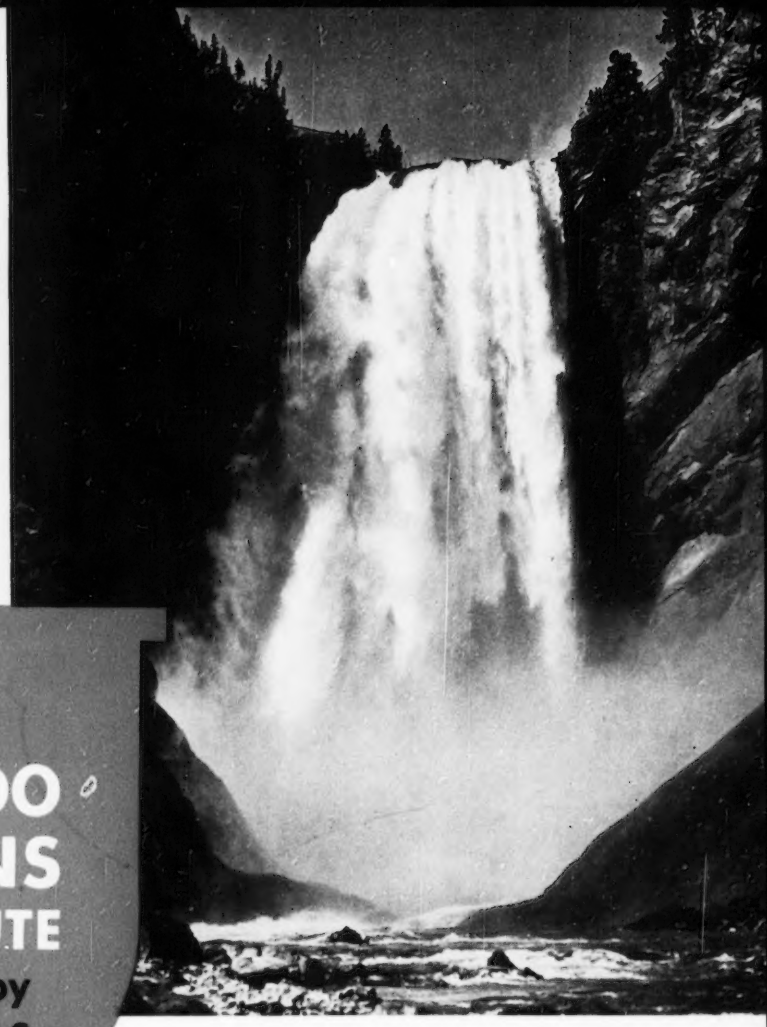
JUNE 1950

FOUNDED 1866



HOW THIS MAN CAN HELP YOU CUT COSTS.... SEE PAGE 56

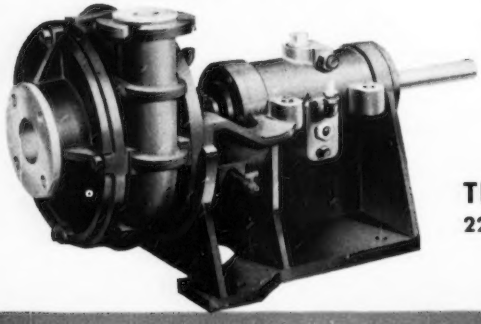
One of Nature's most spectacular sights—Lower Yellowstone Falls.



540,000 GALLONS PER MINUTE

1,925,000 GALLONS PER MINUTE

are pumped by HYDROSEALS throughout the world



EVERY MINUTE over half a million gallons of water thunder down 308 feet into the chasm of Lower Yellowstone Falls. That is a lot of water. Yet it is less than a third of the water delivered every minute by the thousands of Hydroseal Pumps in operation today. And this water is laden with abrasives—sand, gravel, coal, ash, rock—even steel shot. In tropical heat and sub-zero cold, these Hydroseals are proving their superior efficiency and economy in tough pumping jobs. Find out how Hydroseal Pumps can do a better job for you.

Write us.

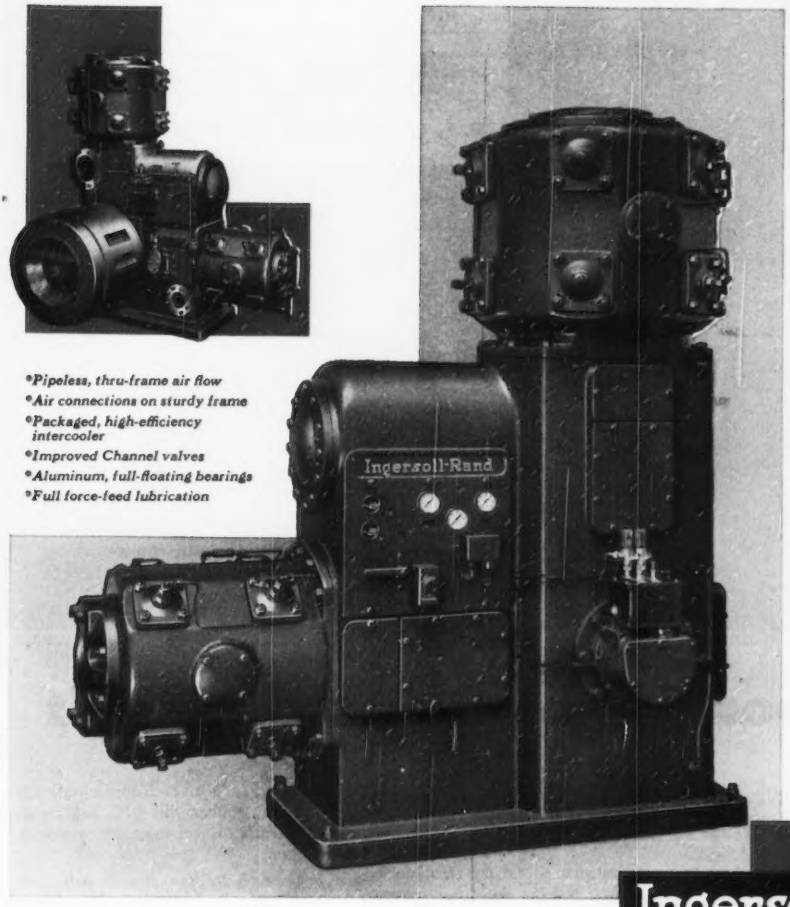
THE ALLEN-SHERMAN-HOFF CO.
229 S. 15th Street • Philadelphia 2, Pa.
Representatives in Most Principal Cities

HYDROSEAL SAND, SLURRY & DREDGE PUMPS
MAXIMIX RUBBER PROTECTED

PACKLESS AND MAXIMIX DESIGN[S] ARE COVERED BY PATENTS AND APPLICATIONS IN THE MAJOR MINING CENTERS OF THE WORLD

HERE'S A *NEW IDEA* IN ELECTRIC-DRIVEN AIR COMPRESSORS

that means lower costs of Installation, Operation and Maintenance



- *Pipeless, thru-frame air flow*
- *Air connections on sturdy frame*
- *Packaged, high-efficiency intercooler*
- *Improved Channel valves*
- *Aluminum, full-floating bearings*
- *Full force-feed lubrication*

A Packaged
"L" DESIGN

THE SIMPLEST
MOST COMPACT
MOST ACCESSIBLE
MOST ECONOMICAL
READY-TO-RUN
HEAVY-DUTY
CROSSHEAD-TYPE

TWO-STAGE
80 to 125 psi

SIZES
125 to 350 hp

Ingersoll-Rand
XLE
507-1

The XLE incorporates a "new look" and a new idea in air-compressor design. It is a heavy-duty, well-balanced, easy-to-keep-clean machine that can be installed with an absolute minimum of effort, time, and cost . . . on a minimum of foundation.

Simplicity of XLE construction, and advanced-design features such as aluminum-alloy full-floating bearings that require no adjustments in a sealed, dust-tight crankcase, result in lower-cost maintenance and a higher degree of dependability.

The XLE is a highly efficient compressor built for continuous, full-load operation, and is ideal for factories, railroad shops, mines, powerhouses, and large construction jobs. It is particularly suitable wherever skid-mounting, factory floor, or ground conditions require a well-balanced machine.

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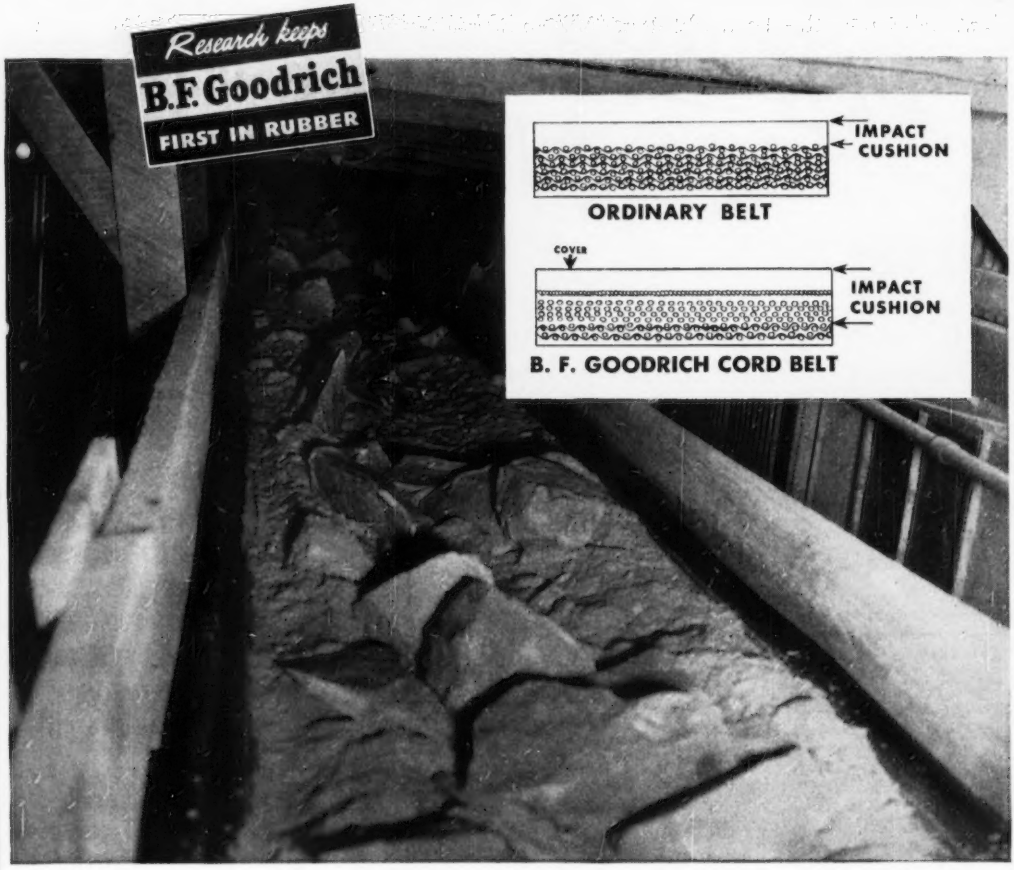

B. F. Goodrich cord conveyor belt

Gives 2 to 6 times greater impact resistance, troughs better, lasts longer

IN the cord plies of a B. F. Goodrich belt each cord is completely surrounded by rubber — no cross threads tie them together. These parallel cords are completely insulated from one another by rubber, free to "give" lengthwise and crosswise when an impact occurs. Thus the rubber can distort temporarily to distribute and absorb shocks that would damage a stiff, unyielding carcass. This augmented impact cushion means better belt service, longer belt life.

Cord belts trough better — Cord belts carry the load with less belt damage, less material "spill." Even thick, narrow cord belts trough naturally. And because they trough better, cord belts keep centered on the idlers, sustain less damage, require less maintenance. Longer centers, higher lifts can be used. Creasing action between idlers (as in a fabric-type belt) is eliminated.

Cord belts last longer, reduce costs — The better impact cushion of cord construction resists cuts and gouges. A transverse cord "breaker" floated above and across the main cord section helps cushion impact, keeps the cover from stretching beyond elastic limits, and provides better adhesion between cover and carcass. With each cord completely sealed in rubber, this BFG belt resists the effects of acid materials, moisture, mildew.

Cord belts for tough jobs — If your belts must take severe impact on loading or "over the idlers," cutting and gouging at the loading chute, exposure to moisture and acid materials, heavy loads with long centers and high lifts, you need BFG cord belts. Your local distributor will show you how they can save you money. *The B.F. Goodrich Company, Industrial Products Division, Akron, Ohio.*

B.F.Goodrich
RUBBER FOR INDUSTRY

ENGINEERING AND MINING JOURNAL

84th YEAR OF PUBLICATION

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Company Offices: Publication office: 210 S. Desplaines St., Chicago 6, Ill. Editorial and Executive Offices: 330 West 42nd St., New York 18, N. Y. Cable address: McGraw-Hill, New York. Branch Offices: San Francisco 4, 68 Post St.; Chicago 11, 520 N. Michigan Ave.; Los Angeles 14, Pacific Finance Bldg.; Washington, D. C., National Press Bldg.; Pittsburgh 22, 738-9 Oliver Bldg.; Detroit 26, 2980 Penobscot Bldg.; Cleveland 15, 1510 Hanna Bldg.; Boston 16, 1427 Statler Bldg.; Philadelphia 3, 17th and Sansome Sts.; Atlanta 3, 1011 Rhodes-Haverty Bldg.; St. Louis 8, Continental Bldg. District Managers: New York, T. E. Alcorn, F. W. Roets; Philadelphia, W. A. Potter; Cleveland, W. M. Spears; Pittsburgh, H. C. Chellson; Chicago, C. J. Cosh and G. A. Mack; San Francisco, J. W. Otterson; Atlanta, R. C. Maultsby; Los Angeles, C. W. Dysinger. London address: McGraw-Hill Publishing Co., Ltd., Aldwych House, Aldwych, London, W.C. 2, England. Cable address: McGraw Hill, London. Other McGraw-Hill foreign news offices in Paris, Berlin, Moscow, Prague, Shanghai and Mexico City.

A McGRAW-HILL PUBLICATION

Subscription information: ENGINEERING AND MINING JOURNAL. June, 1950, Vol. 151, No. 6. Published monthly at Chicago, Ill. Subscription rates: United States and possessions $3 a year, $4 for 2 years, $5 for 3 years. Canada $5 a year, $8 for 2 years, $10 for 3 years. Pan American countries $5 a year, $8 for 2 years, $10 for 3 years. Elsewhere $15 a year, $25 for 2 years, $30 for 3 years. Please indicate position and company connection in all subscription orders. Price of this issue, 50 cents. Entered as second class matter August 16, 1948, at the post office at Chicago, under the Act of March 3, 1879.

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TEXACO

TEXACO

Use the TEXACO air compressor oil recommended for your operating conditions

No ONE oil can lubricate satisfactorily under all the conditions of air compressor operation. So Texaco has developed *a complete line* of air compressor oils. When used as recommended, you can be sure of dependable, top-efficiency operation and lower maintenance costs regardless of the type of compressor or the operating conditions.

Your Texaco Lubrication Engineer, for example, will recommend Texaco straight mineral oils for normal conditions . . . Texaco inhibited oils for rust prevention . . . Texaco special heavy-duty oils where service is severe and carbon and gum formations are problems . . . and Texaco compounded oils if excess moisture is present.

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Let a Texaco Lubrication Engineer help you simplify and improve your maintenance lubrication procedures. Just call the nearest of the more than 2,000 Texaco Wholesale Distributing Plants in the 48 States, or write:

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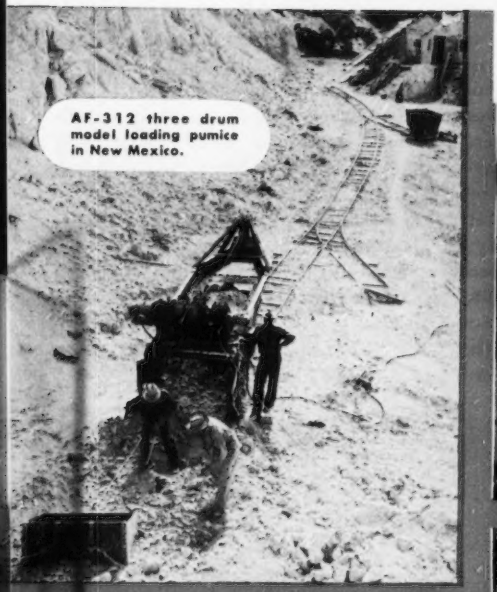
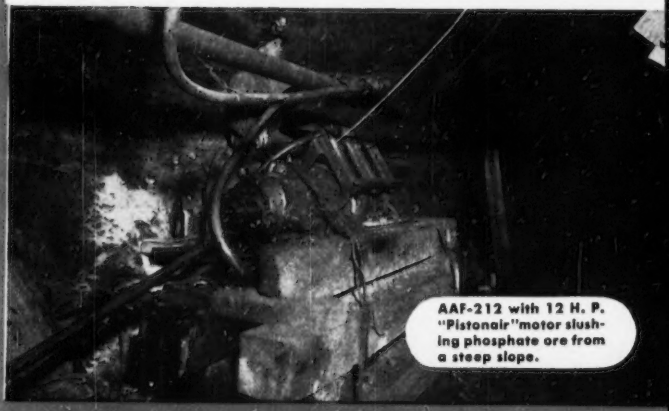
FOR THE MINING INDUSTRY

Known and Used



AF-312 three drum model loading pumice in New Mexico.



AAF-212 with 12 H. P. "Pistonair" motor slushing phosphate ore from a steep slope.

FF-211 with special short length A. C. motor operating in a copper mine.

S-211 "Pee-Wee" Slusher with "Turbinair" motor scraping out a small tunnel heading.

BF-212 Electric Slusher scraping hematite ore in an iron mine.

. . . JOY Sheave with safety hook and quick-opening "snatch block" construction.

WRITE for BULLETINS on JOY EQUIPMENT

the World Over-

JOY SLUSHERS

used and preferred for metal and hard-rock work . . .

because

- **They are designed for this specific service**
- **They are built to stand hard wear and usage**
- **They are available in models and sizes to suit every need**

Air or electric drive	**Portable and heavy-duty**
Single or multiple drums	**Automatic or remote control**

- **They give you long life with low maintenance**

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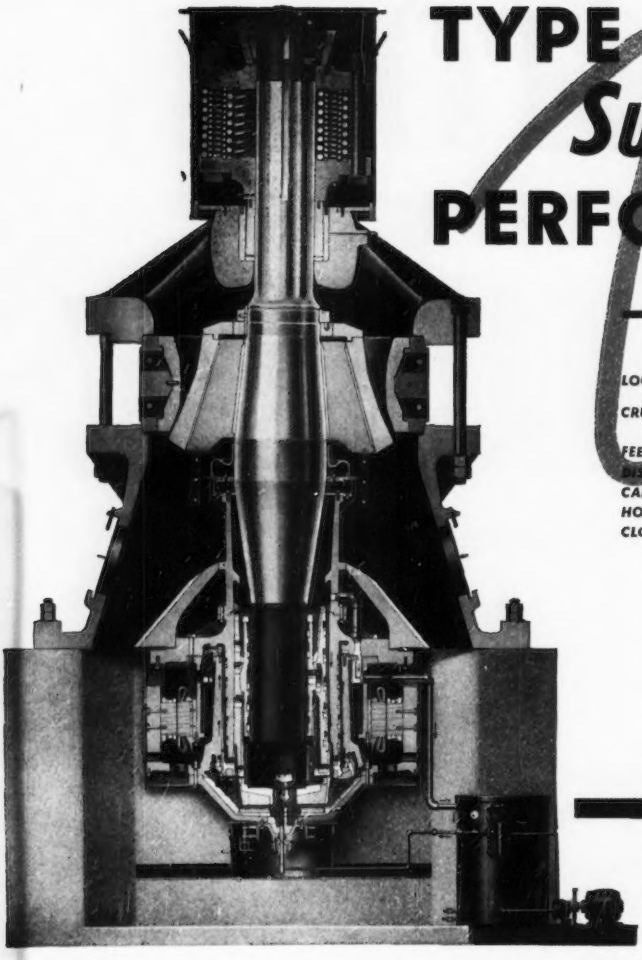
TYPE "S" GIVES *SUPERIOR* PERFORMANCE



—PROOF:

YES — IT CAN BE DONE!

LOCATION: NATIONALLY KNOWN MINING CO. IN NEW YORK STATE
CRUSHERS: FOUR NO. 37½ KENNEDY TYPE "S" ROLLER BEARING GYRATORY CRUSHERS
FEED OPENING: 6¼"; *DIAMETER OF HEAD:* 3 FEET
DISCHARGE SETTING: 7/32" CLOSED SIDE AT HEAD
CAPACITY EACH CRUSHER: 50 TONS PER HOUR
HORSEPOWER EACH CRUSHER: 48 HP.
CLOSED CIRCUIT OPERATION
GRADATION AS FOLLOWS:

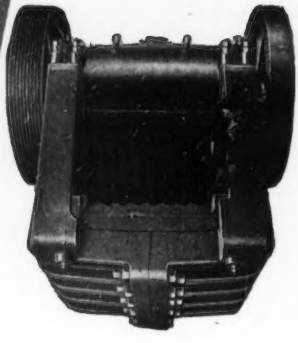
THE FIGURES!

99.8%	Minus	3 MESH
93.3	"	4 "
80.6	"	6 "
66.6	"	8 "
56.1	"	10 "
48.1	"	14 "
40.6	"	20 "

CAN YOU EQUAL THESE FIGURES?
These figures PROVE performance

the SECRET . . .

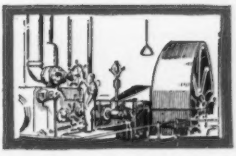
. . . *of* BETTER WORK

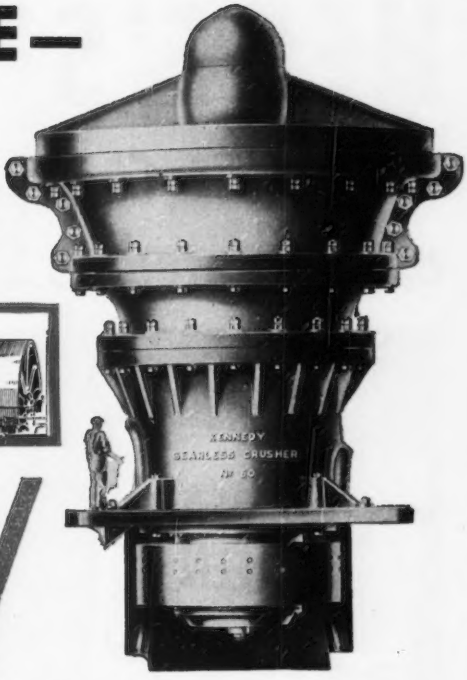


YES — "KVS" felt that Swing Jaw Crushers COULD be improved to do MORE Crushing for LESS POWER — and here's how we did it! Instead of the one SWING jaw doing ALL the work, while the stationary jaw LOAFED, we set BOTH jaws at the same angle, so BOTH jaws carry the load evenly. And that's not all — to make things simpler and stronger, we made the swing jaw ALL ONE PIECE, except the renewable crushing plate. Also, swing and stationary jaws are INTERCHANGEABLE; and also reversible end-for-end. Result — double the Crushing life before replacement. When it comes to real PRODUCTION it's YES — "KVS!"

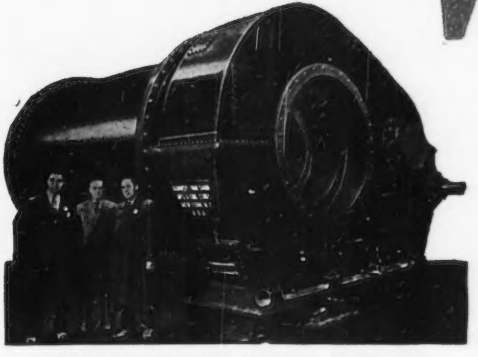
Yes—KVS means the products

CRUSH MORE—
PAY LESS—
WITH KVS





YES — "KVS" puts added FREE crushing POWER into every big "KVS" Gearless Crusher. We do it the way Mr. Corliss did it in the famous Corliss Engine. He put in a big pulley or flywheel, flying around, creating Kinetic Energy. "KVS" Gearless does it with a big whirling pulley, too. You can imagine the extra energy you get from a whirling 8-TON pulley on a 400,000 lb. "KVS," traveling 3,500 ft. a minute! What's more, having no gears, you can turn the pulley yourself with 2 fingers, so smoothly, effortlessly does it work! YES — it's "KVS" for lowcost power, and this is only ONE of the many "KVS" Gearless Crusher features.



...$6,000 *IS YOURS!*

YES — you can save up to $6,000 on a 10 ft. tube or ball mill — if you decide on a "KVS" with integral gear drive. Because then the motor can be *direct-connected* to the driving shaft. The pinion shaft to which the motor is connected runs at approximately 600 r.p.m. The other pinion shafts run at about 180 r.p.m. ON A 10 FT. MILL THIS ENABLES YOU TO PURCHASE THE SYNCHRONOUS MOTOR AT A SAVING OF ABOUT $6,000. What's more, "KVS" trunnions on large sized tube and ball mills are CARRIED ON OIL. The bearing never wears out, uses little power. All gears and bearings are automatically sprayed with oil before tube mill is started (Design patented). YES — it's "KVS" for value, long life. In 15 years no "KVS" gears or pinions have worn out on this type mill.

READY FOR YOU—

YES — there are "KVS" Bulletins covering all the above products, waiting for you. Just write us for them, and YES — we'll send them promptly!

without trouble—

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HERE'S PROOF-

Why Allis-Chalmers Sink-Float Screens are Accepted as Standard on Iron Range

LOW-HEAD SCREEN
Check These Features!
Horizontal operation saves headroom, reduces installation costs.
Entire screen body "stress-relieved" to eliminate strains around welds.
Can be suspended by cables or floor mounted on rubber mountings.
Available with special screen surfaces for abrasive ores.

FOR THE TOUGH job of handling iron ore in sink-float, operators have chosen *Low-Head* vibrating screens. *In fact, every sink-float plant on the iron range uses these Allis-Chalmers screens for this job!*

Some of the reasons: Top performance . . . high media recovery! Maintenance reduced to practically no downtime. And operators know Allis-Chalmers heavy construction pays off in years of service!

The *Low-Head* screen shown above is a typical heavy media screen installation. One of eight *Low-Head* screens installed in the sink-float plant at Holman mines, Taconite, Minn., this 6x16 ft single deck screen is used in the wash and drain process here. It washes media from iron ore concentrate . . . recovers expensive ferro-silicon for re-use.

Allis-Chalmers builds a complete line of vibrating screens—for every application from heavy duty scalping of run-of-mine ore to screens for making fine separations.

There is an Allis-Chalmers representative near you who will gladly look over your operations, show you how proper screening equipment may help you reduce your operating costs. Call him, or send for **Bulletin 07B6330B.** A-3041

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Controls

Texrope Drives

Vibrating Screens

Crushers

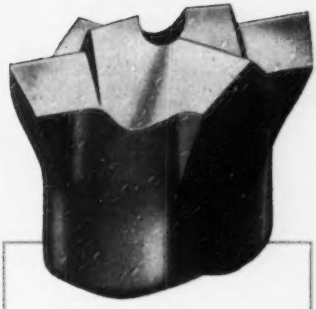
Kilns, Coolers, Dryers

1. MULTI-USE

Gives lowest cost per foot of hole when full increment of drill steel can be drilled and when control and reconditioning of bits are correct.

2. CARBIDE INSERT

For drilling extremely hard and abrasive ground, small holes, extra deep holes. Drillers spend more time drilling—less time changing bits.



3. ONE-USE "SPIRALOCK"

To use where reconditioning is impractical or undesirable. Lowest unit cost. "Spiralock" union holds bit on dependably—permits easy removal.

Only TIMKEN® offers all 3 rock bit types...and a complete Rock Bit Engineering Service!

THERE'S one best bit for every drilling job. And Timken can give it to you. Only Timken makes *all three* rock bit types—multi-use, carbide insert, and one-use. And the Timken Rock Bit Engineering Service helps you select the type, size, and shape to give the drilling performance your job demands—whether it's lowest bit cost, lowest cost per foot of hole, greatest possible drilling speed, or other desired advantage.

FREE BOOKLET: Timken's newest rock bit booklet gives full information on all three types of Timken removable rock bits. Shows full line of bits in actual-size photographs, with detailed descriptions. Write on your company letterhead to The Timken Roller Bearing Company, Rock Bit Division, Canton 6, Ohio. Cable address: "TIMROSCO".

TIMKEN

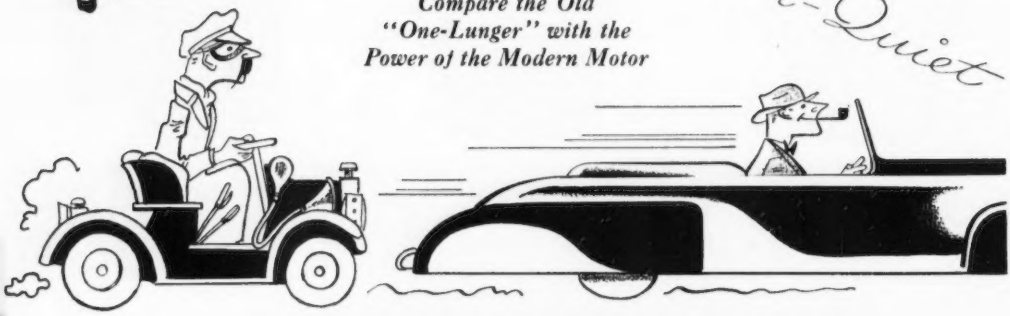
TRADE-MARK REG. U. S. PAT. OFF.

. . . your best bet for the best bit . . . for every job

Yesterday--
JERK ! BANG !

Today--
Smooth-Quiet

Compare the Old "One-Lunger" with the Power of the Modern Motor



...so ROCKMASTER "16" compares with old blasting methods

In the ROCKMASTER "16" Blasting System, pioneered by Atlas, sixteen milli-second delay electric detonators, all starting together, fire at controlled split-second intervals over a period of only a little over a half-second.

Talk to any experienced blaster who has compared ROCKMASTER split-second blasting methods with ordinary instantaneous or delay-action blasting. He'll tell you why it's like comparing a modern multi-cylinder automobile with an old-time one- or two-cylinder model! ROCKMASTER blasting gives a smooth flow of blasting power that means control over throw and breakage never before possible—*with far less noise and vibration!*

Your job may call for two, three, or even all sixteen ROCKMASTER detonators. We help you select them to fit a particular job in quarry, strip pit, mine, construction . . . on the surface or underground. Drill pattern is adjusted to fit the system, often with substantial savings in drilling and dynamite.

Write for your copy of booklet on the ROCKMASTER "16" Blasting System. It includes diagrams for typical loading in quarries, strip pits, mines and many types of construction.

Less Bark *More Bite*

ROCKMASTER "16" TIMINGS

Rockmaster No.	Avg. Time of Each Delay from Zero (milli-seconds)
0 (zero)	0 (inst.)
1	8
2	25
3	50
4	75
5	100
6	125
7	150
8	175
9	200
10	250
11	300
12	350
13	400
14	450
15	500
16	550

ROCKMASTER: Reg. U. S. Pat. Off.

ATLAS EXPLOSIVES
"Everything for Blasting"

CHEMICALS ATLAS EXPLOSIVES

ATLAS POWDER COMPANY, Wilmington 99, Del. • *Offices in principal cities* • *Cable Address—Atpowco*

Easy Moving means faster handling

WHAT about the handling jobs around the mill? Unloading and setting machinery, handling fuel or bulk materials and the hundred and one odd lifting jobs that could cost less and be done more quickly with a Northwest Truck Crane. The Northwest Truck Crane is a better machine for the heavy work of mining and mill operations.

Heavy duty throughout with cast steel rotating base and cast steel machinery side frames. "Feather-Touch" Clutch Control makes operation easy without delicate or complicated mechanisms. Booms can be 30 ft. up to 100 ft. with jib. The Northwest High-Speed Power Controlled Boom Hoist is *independent* of all other operations. Uniform Pressure Swing Clutches take the jerks and grabs out of swinging and conversion to Shovel, Dragline or Pullshovel is accomplished by simply changing booms and without repositioning the base. Add to this the Northwest Carrier, the like of which has never been offered with a Truck Crane before. Heavier duty throughout with better load distribution, better frame reenforcing and outrigger design that assures greater stability during crane operation. We'd like to give you the story in detail. Why not ask for it?

NORTHWEST ENGINEERING CO., 1509 Field Bldg., 135 South LaSalle St., Chicago 3, Ill.

NORTHWEST

Convertible for any Mining Material Handling or Excavation Problem

1 TOURNADOZER

Maintains Haul Roads — Rugged, 2½-yard blade, plus high-speed operation, enable Tournadozer to maintain haul roads, fill washouts, grade shoulders . . . at working speeds up to 3 times faster than conventional slow-moving crawlers.

Skids Equipment — Four-wheel drive on 21.00 x 25 low-pressure tires provides ample power and traction for hauling heavy equipment around the pit. Here, Super C Tournadozer quickly maneuvers cable boat for large stripping shovel.

Cleans Tracks — Mobile "C" moves in fast from other assignments to clean up ore spilled near hopper. Tournadozer can cross tracks or follow rail lines anywhere, without planking. Big, rubber tires prevent damage to rails, leave no chamfered or gouged ties.

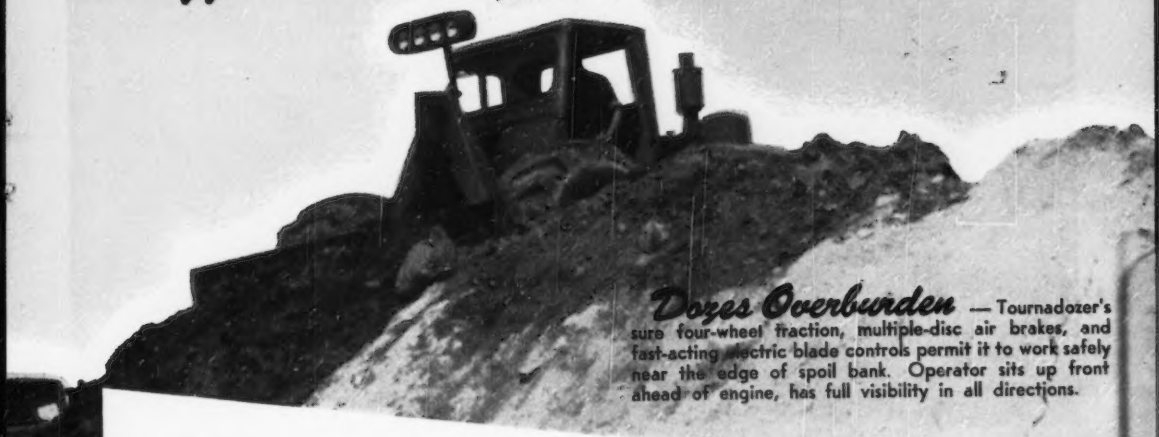
Spots Railway Cars — Rubber-tired Tournadozer is handy for moving cars in yards or on siding. Can push or snake with cable. Here versatile Tournadozer spots empty railcars under ore loader for this Mesabi Iron Range mining company.

LETOURNEAU LET

See your Le Tourneau Distributor NOW for complete information

handles 7 assignments

in typical day at Mesabi Mine



Dozes Overburden — Tournadozer's sure four-wheel traction, multiple-disc air brakes, and fast-acting electric blade controls permit it to work safely near the edge of spoil bank. Operator sits up front ahead of engine, has full visibility in all directions.

Near Keewatin, Minnesota, one high-speed, rubber-tired C Tournadozer profitably performs a variety of widely scattered jobs for a Mesabi Range mining operation. During a typical 24-hour day in the company's 7-day work week, Tournadozer maintains spoil dump . . . dozes overburden . . . cleans spillage from stripping shovels and haul units . . . skids electric cable boats . . . switches railroad cars. And, the many extra uses for the high-speed Tournadozer are still increasing daily.

Saves Several Hours in Job-to-Job Moves Alone

Routine job trips around the mine vary from ¼ mile to 7/10 mile. On the longer trips to other areas, fast, rubber-tired "C" takes the shortest route — over paved roads. It doesn't have to take the long, unimproved back road route their crawlers must use. There is no roadbed on which the Tournadozer is prohibited. The Tournadozer's "work-and-get-around-ability" saves up to two hours each trip . . . uses the hours saved for *extra* assignments around the mine. Tournadozer not only gets places faster . . . but it makes twice as many dozing cycles on the job as ordinary crawlers.

Faster on any Dozing Job

Fast, mobile Tournadozer handles multiple assignments for this Minnesota company, and will for *you*, too. For complete information on this Super C Dozer, write or phone your LeTourneau Distributor. He is ready to show what this job-proved unit can do on your work. Ask him for facts and figures on the many Tournadozer uses TODAY.

Tournadozer-Trademark Reg. U. S. Pat. Off. M22

LETOURNEAU PEORIA, ILLINOIS — JOB-PROVED over 645 Built and Shipped — **TOURNADOZERS**

IT'S RUBBER THAT PUTS THE ACTION IN TRACTION

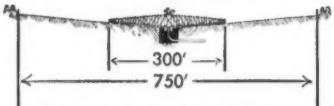
750 FOOT THICKENER 300 FOOT DORR MECHANISM

Team for economy at American Cyanamid's Sydney Mine

How to clarify 15,000 gpm of phosphate rock tailings water carrying 2% solids—on a budget? That was the problem facing the American Cyanamid Company at their Sydney Mine in 1948. Overflow had to be clear enough for reuse—underflow thick enough for practical impounding.

Our answer to the problem—based on thorough study and field testing—was the installation pictured above. A 300′ dia. special Dorr SSG Thickener mechanism, incorporating a flocculating feedwell and picket arms, installed in a 750′ dia. earthen basin with a sloped bottom. Preliminary thickening to a concentration of approximately 6% solids takes place in the outer, unswept, portion of the basin. Final thickening to 12-15% solids is effected by the mechanism in the central area.

This unusual installation—the world's largest settling basin served by a single mechanical unit—has just gone into initial operation. It is one more example of an unusual sedimentation problem solved by Dorr—the oldest manufacturer of sedimentation equipment . . . with the *newest* ideas.



Diagrammatic sketch of 300′ dia. Dorr Thickener installed in 750′ dia. earthen tank at American Cyanamid Company's Sydney Mine near Brewster, Florida.

DORRCO

THE DORR COMPANY, ENGINEERS
BARRY PLACE, STAMFORD, CONN.

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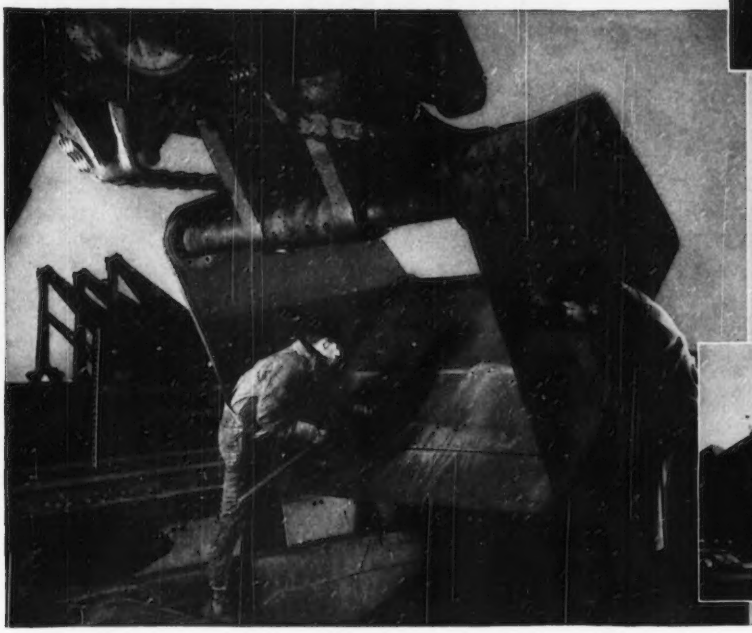
ASSOCIATES AND REPRESENTATIVES
Dorr Technical Services and Equipment Are Also Available Through Associated Companies and Representatives in the Principal Cities of the World. Names and Addresses on Request.

DORR

RESEARCH ENGINEERING EQUIPMENT

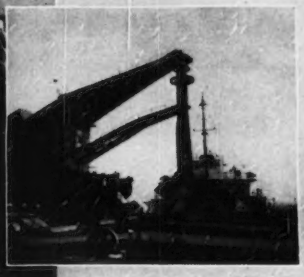
UNION DOCK CO. SAVES $6,500 IN MAINTENANCE WITH J&L JALLOY HEAT-TREATED STEEL

J&L STEEL



Left: Inspecting one of the J&L Jalloy Steel "trays" of the huge clamshell bucket on a Hulett ship unloader.

Below: The operator rides with the clamshell as it descends into the freighter's hold.



"OPERATION CLAMSHELL" proves value of new J&L abrasion-resistant steel.

Scooping up tons of highly abrasive iron ore and quartzite from the holds of ships, the Union Dock Co., Ashtabula, Ohio, found that sections of clamshell buckets and other parts of huge ship unloaders wore out, frequently causing costly delays while replacements were made.

To speed up unloading schedules and cut costs, Union Dock tried J&L JALLOY heat-treated steel plates and bars on its toughest applications.

Result: After unloading nearly 3½ million tons of raw, abrasive materials in less than two seasons, Union Dock's records showed that $6,500 had been saved in maintenance cost alone on four mammoth Hulett unloading machines. This does not include reduced operating costs resulting from shorter dock time.

Wherever JALLOY Steel is tried for material-handling equipment, similar astonishing records are being made. This new heat-treated manganese-moly alloy steel is solving maintenance problems wherever great tensile strength and unusual resistance to abrasion and impact are required.

We have the complete story on "Operation Clamshell"— the name given to the test of J&L JALLOY by Union Dock Company. It includes a table of all applications and compares the service obtained from JALLOY with that of the steel previously used. Let us send you a copy —also a copy of the booklet: "For Longer Wear . . . Less Repair." It describes how others have saved money with this new, abrasion-resistant steel.

Jones & Laughlin Steel Corporation
412 Jones & Laughlin Building,
Pittsburgh 30, Pa.

☐ Please send me a copy of "Operation Clamshell," giving results of Union Dock Company's test of J&L JALLOY Steel.

☐ Also a copy of "For Longer wear...Less Repair—Jalloy—J&L Special Alloy Steel."

NAME_____

COMPANY_____

ADDRESS_____

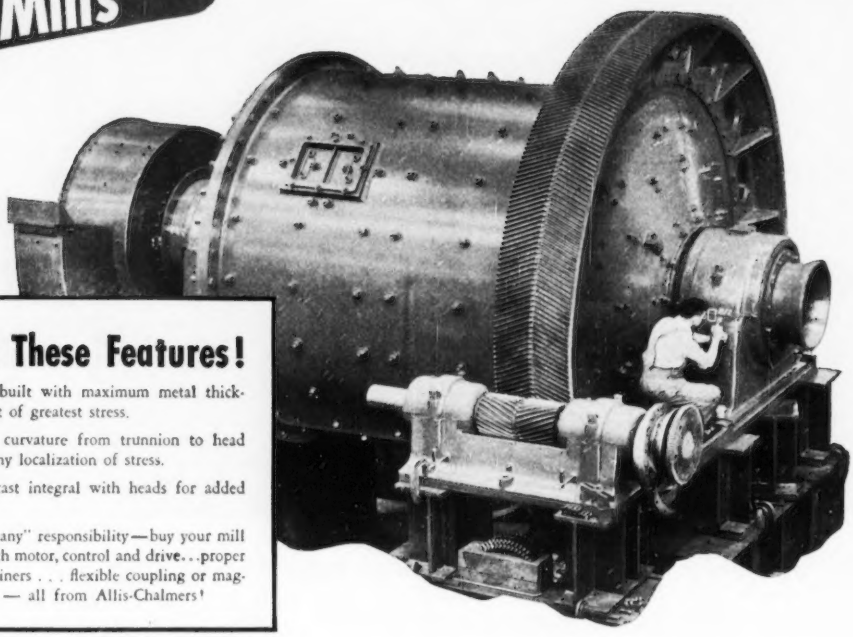
JONES & LAUGHLIN STEEL CORPORATION

From its own raw materials, J&L *manufactures a full line of carbon steel products, as well as certain products in* OTISCOLOY *and* JALLOY *(hi-tensile steels).*

PRINCIPAL PRODUCTS: HOT ROLLED AND COLD FINISHED BARS AND SHAPES • STRUCTURAL SHAPES • HOT AND COLD ROLLED STRIP AND SHEETS • TUBULAR, WIRE AND TIN MILL PRODUCTS • "PRECISIONBILT" WIRE ROPE • COAL CHEMICALS

Overcome Problem of High Starting Torque

ALLIS-CHALMERS Grinding Mills



Check These Features!

- Trunnions built with maximum metal thickness at point of greatest stress.
- A gradual curvature from trunnion to head eliminates any localization of stress.
- Trunnion cast integral with heads for added strength.
- "One company" responsibility—buy your mill complete with motor, control and drive...proper feeder and liners . . . flexible coupling or magnetic clutch — all from Allis-Chalmers!

TRUNNION BEARINGS on all the larger sizes of Allis-Chalmers grinding mills are supplied with an individual high pressure lubricating pump to provide lubricant between mill trunnion and bearing during initial starting, insuring minimum starting torque and bearing wear.

Hand operated bearing lubricating pump.

Floating the mill in this way results in much less punishment to vital parts. Reduced starting torque gives you less strain on gear teeth and less torsional strain on the pinionshaft.

REDUCES DOWNTIME

Protection from excessive wear and strain in starting your mill will prove to be immensely important in terms of less costly maintenance and less idle mill time. Another reason it pays to specify A-C mills!

Allis-Chalmers builds a complete line of grinding mills: ball and rod mills; pebble mills, Compeb and Ballpeb mills. The A-C representative in your area can be a big help in working out grinding problems. Call him today, or write: A-3044

ALLIS-CHALMERS, 969A SO. 70 ST. MILWAUKEE, WIS.

Compeb, Ballpeb and *Texrope* are Allis-Chalmers trademarks.

ALLIS-CHALMERS

Sales Offices in Principal Cities in the U. S. A. Distributors Throughout the World.

Motors

Controls

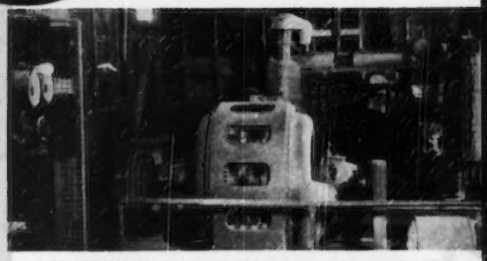
Texrope Drives

Vibrating Screens

Crushers

Kilns, Coolers, Dryers

NO "RINGERS" ON THIS TEAM



A "Cat" D8800 Diesel drives this 75-kw. generator for powering 205 feet of conveyor belt and lights for Basic Refractories' shop. About 440 tons of material move over these belts to steel shipping bins. This "Cat" Diesel ran 16 hours a day for 5 years—operated 24" x 36" jaw crusher and conveyor belts for 6 years.

A "Cat" D13000 Diesel Engine powers this Bucyrus-Erie 1½-yd. shovel for handling 1250 tons of brucitic materials per day, using only 55 gallons of fuel in 16 hours. The pit where this machine is working has been dug 330 feet deeper since 1936 – all by "Caterpillar" equipment.

Powered by a "Cat" D13000, this Worthington Bluestreak Compressor provides 315 cu. ft. of air per minute for drilling an average of 250 ft. of 3-inch holes every 8 hours.

It's a smart coach who uses equipment built and "trained" to work well together. That is why C. H. Connor, controller of Basic Refractories, Inc., near Gabbs, Nevada, standardized with all-"Cat" power units to get best results for lowest operating costs. His team of big yellow Diesel Engines is precision-built for long, trouble-free service under the toughest operating conditions.

Users of "Caterpillar" equipment like the important advantages of the "Caterpillar" dealer and parts-replacement service, too. Thousands of parts – including non-current items – are stocked at 8 huge parts depots throughout the country, as well as with the dealer himself. Such parts service eliminates loss of job time.

Wherever you are, your "Caterpillar" dealer service is as close as your phone. Why not ask him to *show* you what "Cat" Diesel Engines can do for you?

CATERPILLAR TRACTOR CO. • PEORIA, ILLINOIS

LOOK UNDER THE HIDE

Quality doesn't show on the outside —it shows up in performance

"Caterpillar" cylinder heads are made of copper-molybdenum iron. Built with rugged reinforcing members, the head design gives large air ports for maximum engine power. Ample spacing between valves, and wide water passages prevent steam pockets—offer utmost resistance to cracking—give long head life. Water passages are designed to guide the water next to valve seats and precombustion chambers to keep head temperatures uniform. *Look under the hide for quality.*

CATERPILLAR
REG. U. S. PAT. OFF.

DIESEL ENGINES • TRACTORS
MOTOR GRADERS
EARTHMOVING EQUIPMENT

BONUS YARDAGE EVERY SHIFT

DIGGING overburden that averages 22 feet in depth, and mining a 10-foot bed of Florida phosphate rock, this Bucyrus-Erie 650-B walking dragline is on the job 24 hours a day, seven days a week. Its ability to keep working month after month, through fair weather or foul, has been reflected in the "bonus yardages" that set outstanding production records.

Big dependable yardages are an old story to owners of Bucyrus-Erie stripping shovels and draglines. Owners know that fast, smooth operating cycles combined with on-the-job reliability mean extra output every shift . . . that sound, *years ahead* design and durable construction mean dependability that takes years of hard service in its stride. 98L50

BUCYRUS ERIE

SOUTH MILWAUKEE, WISCONSIN

2 ways to Better Air Service

GOODYEAR INDUSTRIAL RUBBER PRODUCTS
-Specified EMERALD CORD AIR HOSE for
ALL HEAVY-DUTY TYPES OF AIR SERVICE
A—Super-tough, non-gouging green cover
B—Reinforcement of high-strength cord impregnated with "Adhezo" for greatest strength, best adhesion, reduced wall gauge
C—Non-porous, seamless, oil-resistant, non-flaking tube
A
B
C
Emerald Cord Air Hose is made with one, two or three braids depending on severity of service—is the finest air hose available anywhere.
GOODYEAR INDUSTRIAL RUBBER PRODUCTS
-Specified REDWING-H CORD AIR HOSE for
MINES, QUARRIES, CONSTRUCTION JOBS
(direct connection to compressors, etc.)
A—Rugged red cover of "cushiony" rubber stock
B—Rayon cord braids for strength and resistance to shock blows
C—Non-porous, seamless, oil-resistant tube will not flake
A
B
C
FOR HOSE, FLAT BELTS, V-BELTS, MOLDED GOODS, PACKING, TANK LINING built to the world's highest standard of quality, phone your nearest Goodyear Industrial Rubber Products Distributor.

FOR the best service at the lowest cost in the long run, ask the G.T.M.—Goodyear Technical Man—for either of these pace-setting hoses. Emerald Cord is the finest air hose made—Redwing-H Cord gives high quality at a lower price. To consult the G.T.M., phone your nearest Goodyear Distributor, or write Goodyear, Akron 16, Ohio.

Emerald Cord, Redwing—T.M.'s The Goodyear Tire & Rubber Company

GOODYEAR

THE GREATEST NAME IN RUBBER

We think you'll like "THE GREATEST STORY EVER TOLD"—Every Sunday—ABC Network

"the tougher the rock, the better the driving"

This adage among hard-rock men might sound contradictory to the layman. But miners and tunnel drivers know that progress slows down when they run into formations that are seamy and easily fragmented. Rock that is tougher and more solid usually makes possible a faster rate of advance.

But whatever your rock conditions may be, you can always depend on Bethlehem Hollow Drill Steel to help you keep drilling on schedule. Having this "old reliable" steel on the job means you can just about forget your drill steel problems. It's a fine steel, through and through . . . with the tough, fatigue-resisting properties that keep drill steel costs at rock bottom.

Specify it by name: Bethlehem Hollow. Prompt delivery of all standard sizes and sections from your nearest supplier or our mill.

★ *Ideal for either forged or detachable bits*
★ *Smooth center hole minimizes fatigue failure*
★ *Wide quenching range for easy heat-treating*
★ *Controlled hardenability for top performance*
★ *Rigidly inspected for quality and uniformity*

BETHLEHEM STEEL COMPANY, BETHLEHEM, PA.

On the Pacific Coast Bethlehem products are sold by
Bethlehem Pacific Coast Steel Corporation
Export Distributor: Bethlehem Steel Export Corporation

BETHLEHEM HOLLOW DRILL STEEL ★ BETHLEHEM STEEL ★

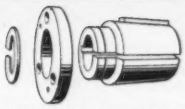
4 BIG ADVANTAGES!

ONE PIECE MOUNTING

Bushing and sheave go on together. One motion mounting. Alignment is easier. Sheave is on right first time.

POSITIVE DRIVE

Bushing is keyed to both shaft and sheave. No slipping. No sheared screws. No jammed bushings from bent screws.



FULL CIRCLE GRIP

Bushing split full length with separate collar. Grips shaft full length around full diameter. No forcing or distortion. Grip easily broken. No hammering.

WIDE SIZE RANGE

Magic Grip sheaves are available from 3" pitch diameter up. Style NC bushing for smaller sizes and Style C bushing for larger sizes.

MAGIC GRIP SHEAVE

YOU CAN MOUNT a *Magic Grip* sheave faster than any other sheave you can buy . . . and demount it just as fast. When you mount a *Magic Grip* sheave it runs true. It will not slip or jam. It always comes off easily.

Even if you don't change sheaves often, you should have *Magic Grip* sheaves on every drive to eliminate the possibility of shaft and bearing damage when ordinary sheaves are hammered or pried on or off.

WIDEST V-BELT LINE

Get everything you need for your V-belt drives from one reliable source. *Texrope* offers the broadest line of V-belts, standard and variable speed sheaves and speed changers in the industry. And you also get the extra engineering skill that comes from having more industrial V-belt installations than any other manufacturer.

Get your copy of the 144 page *Texrope* Pre-Engineered Drive Manual from your A-C Authorized Dealer or Sales Office or write for Bulletin 20B6956.

A-3022

ALLIS-CHALMERS, 969A SO. 70 ST.
MILWAUKEE, WIS.

Texrope and *Magic Grip* are Allis-Chalmers trademarks.

Sold . . .
Applied . . .
Serviced . . .

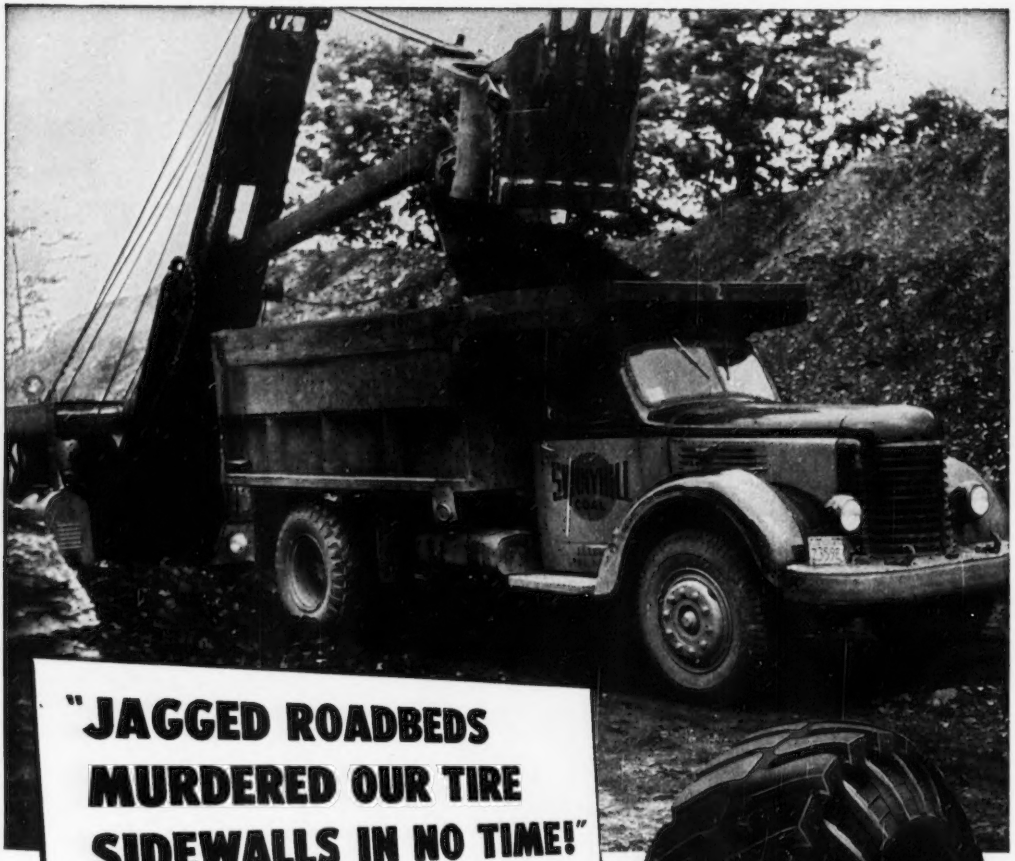
by Allis-Chalmers Authorized Dealers, Certified Service Shops and Sales Offices throughout the country.

MOTORS — ½ to 25,000 hp and up. All types.

CONTROL — Manual, magnetic and combination starters; push button stations and components for complete control systems.

PUMPS — Integral motor and coupled types from ¾ in. to 72 in. discharge and up.

ALLIS-CHALMERS



"JAGGED ROADBEDS MURDERED OUR TIRE SIDEWALLS IN NO TIME!"

says Mr. J. E. Lewis, Owner,
J. E. Lewis Company, Imperial, Pa.

"Until we went 100% for U. S. ROYALS."

"The roads my trucks travel are the toughest kind. And the biggest trouble with tires I have used has been sidewall wear. Now, in U. S. Royal Lug Traction Tires, I have strong and lasting sidewalls."

You'll want Lug Tractions for your operation, too—sharp, massive lugs for deep penetration . . . lugs and shoulder designed to resist cuts and bruises . . . sturdy center running rib that means smooth rolling—resistance to side-slip. And your U. S. Royal Distributor has a tire maintenance plan especially designed for you—call him today!

U. S. ROYALS

PRODUCT OF UNITED STATES RUBBER COMPANY

ANOTHER
COPPUS
"BLUE RIBBON" PRODUCT
This is the Coppus VENTAIR. A centrifugal blower, it is designed for long pipe lines, high pressures.
This is the Coppus VANO. The propeller-type, best for shorter pipe lines, medium pressures.

These are the cost-reducing Blowers that give up to 100% more air

Only Coppus makes both types — and both are made especially for *mine* ventilation. One or the other, operating under the conditions for which it is designed, delivers from 30% to 100% more air for a given power consumption than an ordinary all-purpose fan.

They can be used as blowers or exhausters and are driven either by compressed air or electric motor, with capacities up to 90,000 CFM. Like all Coppus products, these blowers wear the "Blue Ribbon" that stands for high achievement in engineering, workmanship and performance.

Representatives listed in MINING CATALOGS. Other Coppus "Blue Ribbon" products: steam turbines, gas burners, heat killers, air filters, blowers and exhausters for special purposes. See also THOMAS' REGISTER . . . Coppus Engineering Corp., Worcester 2, Mass.

COPPUS ENGINEERING CORPORATION
286 Park Avenue, Worcester 2, Mass.

Please send.....Bulletin 130

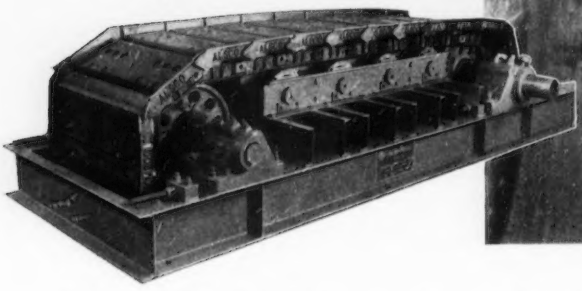
Name .....

Company .....

Address .....

RUN-OF-MINE ORE

Can't Choke This Feeder



Rugged AMSCO Pan Feeders are giving good service under severe operating conditions in scores of installations we can point out. One for example is a mine where thousands of tons of heavy copper ore pound through from a large surge hopper. This feeder's extra-wide pans prevent arching, or blocking, of the ore in the throat of the bin. Incredibly sturdy and durable, the AMSCO is designed and built for continuous, trouble-free service.

S-A engineers are proud of this unit. It's practical evidence that both S-A engineering and manufacturing answer the toughest problems in bulk materials handling—a record backed by fifty years experience.

Invite S-A engineers to discuss your bulk materials handling. *Write today!*

COPPER MINE INSTALLATION

The giant manganese steel pans of this AMSCO feeder are 10'-6" wide. Distance between shaft centers is 25 feet. A 20 HP variable speed drive permits handling range of from 250 to 1000 TPH. Trucks haul ore from open pit to surge bin under which this S-A AMSCO pan feeder operates. Ore from surge bin feeds over a heavy manganese steel bar grizzly which passes fines to belt conveyor but directs oversize lumps into a primary crusher. Ore in storage is instantly available in any quantities required for processing at the concentrator.

STEPHEN S-A ADAMSON MFG. CO.

4 Ridgeway Avenue, Aurora, Illinois · Los Angeles, Calif. • Belleville, Ontario

DESIGNERS AND MANUFACTURERS OF ALL TYPES OF BULK MATERIALS HANDLING EQUIPMENT

NOW for the first time...

...A HIGH-VOLTAGE INSULATION WITH ALL THE PROPERTIES NECESSARY FOR TROUBLE-FREE SERVICE UNDER ALL OPERATING CONDITIONS...

LOW WATER ABSORPTION

OZONE RESISTANCE

RESISTANCE TO HEAT and AGING

SIMPLEX-ANHYDREX XX

Here at last, in the new Anhydrex XX insulation, is the combination that assures dependable, low-cost cable performance under all conditions of high-voltage service. And in Anhydrex XX none of the effectiveness of one property has been sacrificed to gain the others.

Aged in an air oven for sixteen weeks at the grueling temperature of 250 F. (121 C.) Anhydrex XX remained rubber-like in quality and appearance, was still suitable for continued use. It retained approximately half of its tensile strength, nearly two-thirds its elongation. Most important of all, its rate of deterioration after the first few weeks was very slight, indicating exceptional stability and long life.

Ordinary oil base and heat-resistant compounds could not match this performance. Inside of only three weeks both had become brittle and, upon bending, immediately cracked and crumbled.

Aged at the same high temperature for seven days, Anhydrex XX was immersed for a week in distilled water at 158 F. (70 C.). It would not absorb more than 15 mg. per square inch of exposed surface. Bent around a mandrel, it was exposed to .03% ozone for four hours yet would not crack.

Anhydrex XX is the only insulation that provides this valuable combination. So that you may determine fully the effectiveness and stability of these properties even after years of service, we have drawn up an ironclad specification for Anhydrex XX which we will gladly send you upon request. Simply fill in and mail the coupon below.

SIMPLEX WIRES & CABLES

SIMPLEX WIRE & CABLE CO.
79 Sidney St., Cambridge 39, Mass.

SIMPLEX WIRE & CABLE CO.
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GENTLEMEN: PLEASE SEND A COPY OF SPECIFICATION 1685 TO:

NAME _____ TITLE _____

COMPANY _____

STREET _____

CITY _____ STATE _____

BIGGEST WIRE ROPE NEWS IN YEARS!

2 NEW WIRE ROPES
PROVE COMPLETELY SUPERIOR AND LONG-LIVED
ON EXCAVATING MACHINES

AFTER THE TOUGHEST TESTS in actual service, the new Roebling 6 x 43 and 6 x 49 Wire Ropes are ready to help you get things done with remarkable savings of wire rope dollars. These two new ropes are exclusive developments and made only by Roebling. As hoist ropes on shovels and draglines and as thrust and counterweight ropes on shovels they have proved in a class by themselves.

The new 6 x 43 and 6 x 49 are Blue Center Steel Lang Lay, with Independent Wire Rope Core and Roebling Preforming. Outside wires are *large*, for greatest resistance to wear and tear and abrasion...inside wires are *small*, for maximum flexibility, handling ease and operating efficiency. This type of construction spells extraordinary efficiency and completely new measures of economy for users of medium and large size shovels, draglines, and dredges.

Have your Roebling Field Man help choose the *right* rope for your machines. He is in close contact with Roebling Engineers...and this team is constantly solving every type of wire rope problem. ***That's why...***

Today it's Roebling!

ROEBLING A CENTURY OF CONFIDENCE

Atlanta, 934 Avon Ave. ★ *Boston*, 51 Sleeper St. ★ *Chicago*, 5525 W. Roosevelt Road ★ *Cincinnati*, 3253 Fredonia Ave. ★ *Cleveland*, 701 St. Clair Ave., N. E. ★ *Denver*, 4801 Jackson St. ★ *Houston*, 6716 Navigation Blvd. ★ *Los Angeles*, 216 S. Alameda St. ★ *New York*, 19 Rector St. ★ *Philadelphia*, 12 S. Twelfth St. ★ *Portland*, 1032 N. W. 14th Ave. ★ *San Francisco*, 1740 Seventeenth St. ★ *Seattle*, 900 First Ave. S.

JOHN A. ROEBLING'S SONS COMPANY, TRENTON 2, NEW JERSEY

Grand Valley Tunnel Completed in Record Time

THE DAILY SENTINEL

VOL. LVII GRAND JUNCTION, COLORADO, THURSDAY EVENING, APRIL 19, 1956 NO. 183

2,240-Foot Bore Being Completed Over Month Ahead of Schedule

Cleanup Work Already Underway So First Water Can Be Turned In As Soon As Possible; Speed Record Set In Both Drilling and Contracts

A 2,240-foot bypass around that portion of the Grand Valley project tunnel No. 3 which closed completely March 8 was holed thru at 12:12 a. m. today.

Cleanup work was started immediately and it is expected the first water of 1950 [illegible] 50-mile ditch below the tunnel May 1 or sh[illegible] thru, so in you go.

The 1,500 project farmers in this arid climate their near[illegible] land would have been unpr[illegible] 6,000 acres of peach trees [illegible]

It's a clean-appearing bore 13 feet in diameter. You can tell where each shot was set off, since the bore is slightly wider at the center of the blast. Crews are still hauling muck out from the previous blast as your go in. You find [illegible] and [illegible] of the bureau watching crews load out four-yard ore cars every 40 seconds. [illegible]

Grand Valley Tunnel has been holed through with more than a month to spare in the 70-day contract. The 2240 foot tunnel is to be finished inside 11' x 11½' horseshoe and the excavated section is approximately two feet greater in each dimension.

When the daily advance figures are available, there is a probability that a new world's speed record will have been established for this size tunnel.

Dependable Eimco RockerShovels used in both ends of the bore helped speed the advance by moving the large quantities of broken rock quickly and efficiently.

Eimco RockerShovels are built to load the customers car faster and cheaper. There is a RockerShovel to fit your needs. Write for more information.

EIMCO

THE EIMCO CORPORATION

The World's Largest Manufacturers of Underground Rock Loading Machines

EXECUTIVE OFFICES AND FACTORIES — SALT LAKE CITY 8, UTAH, U. S. A.

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NEW YORK, 51-52 SOUTH STREET • CHICAGO, 3319 SOUTH WALLACE STREET
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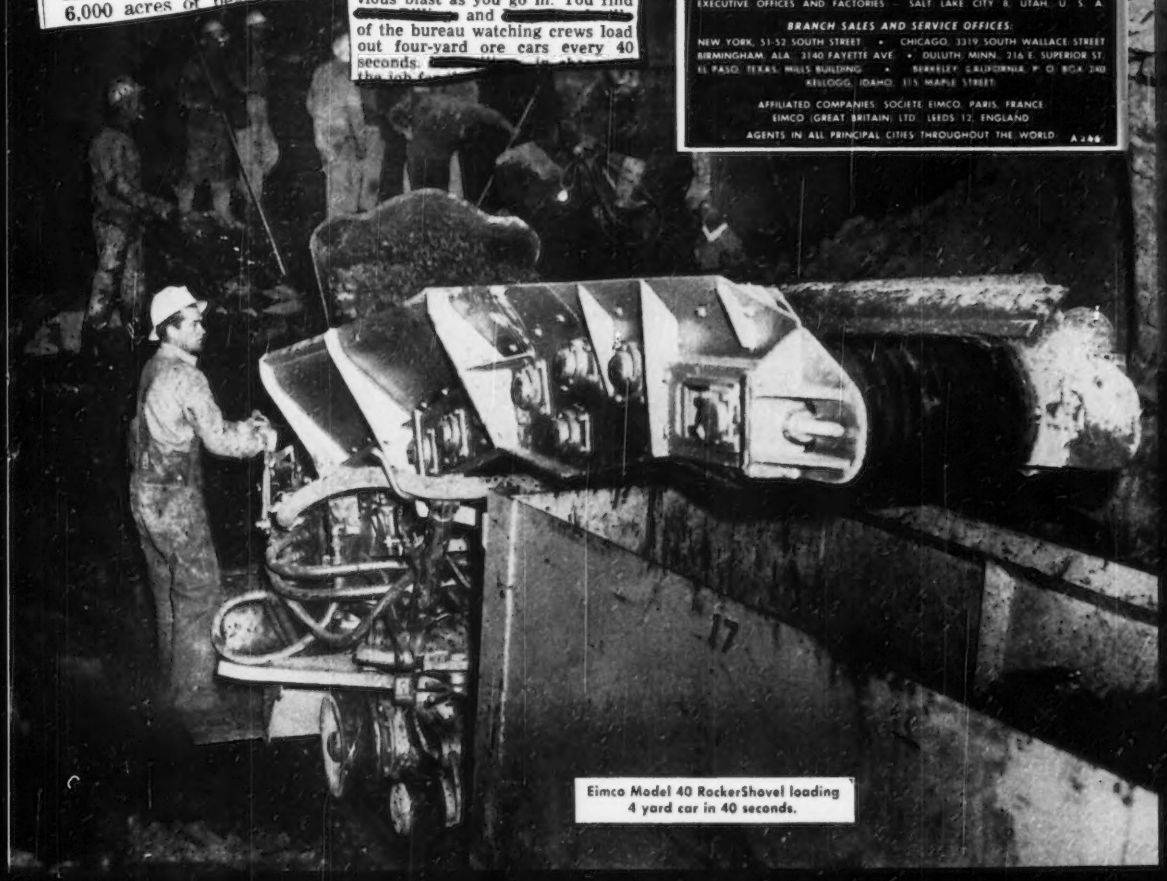
EL PASO, TEXAS, MILLS BUILDING • BERKELEY, CALIFORNIA, P. O. BOX 2402
KELLOGG, IDAHO, 115 MAPLE STREET

AFFILIATED COMPANIES: SOCIETE EIMCO, PARIS, FRANCE
EIMCO (GREAT BRITAIN) LTD., LEEDS 12, ENGLAND
AGENTS IN ALL PRINCIPAL CITIES THROUGHOUT THE WORLD A-286



Eimco Model 40 RockerShovel loading 4 yard car in 40 seconds.

2 to 3 times longer

with these new Fatigue-Resistant

An exclusive development of
AMERICAN STEEL & WIRE COMPANY

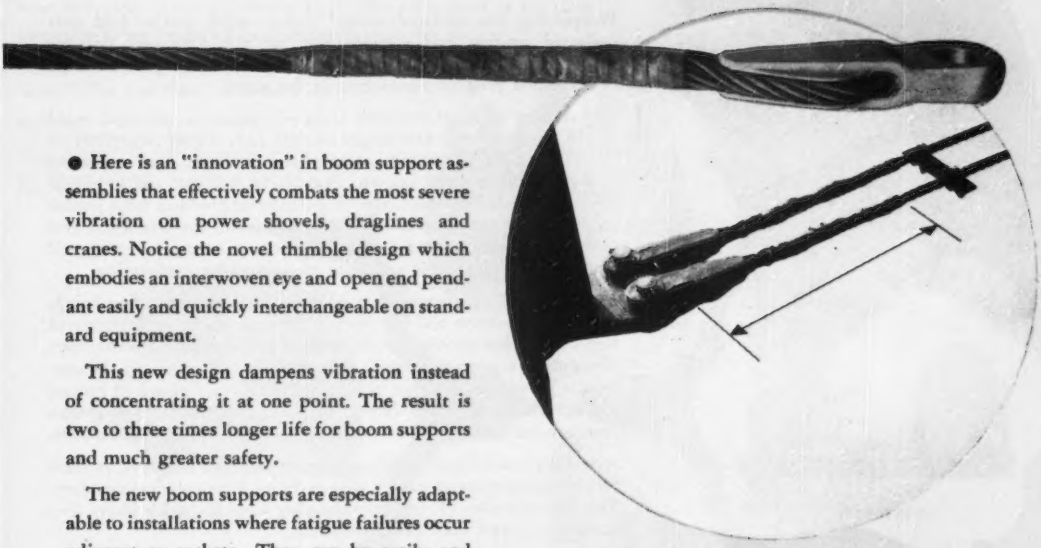
REPLACE YOUR OLD BOOM SUPPORTS with these new Tiger Brand FATIGUE-RESISTANT Boom Support Assemblies. Field tests and laboratory vibration tests indicate at least two or three times the usual length of life under the most severe vibration conditions.

USS AMERICAN TIGER BRAND WIRE ROPE UNITED STATES STEEL

NEW TIGER BRAND FATIGUE-RESISTANT BOOM SUPPORT ASSEMBLIES on a 5 cu. yd. dragline near Pittsburgh, Pa.

life for boom supports

Tiger Brand Cable Assemblies



● Here is an "innovation" in boom support assemblies that effectively combats the most severe vibration on power shovels, draglines and cranes. Notice the novel thimble design which embodies an interwoven eye and open end pendant easily and quickly interchangeable on standard equipment.

This new design dampens vibration instead of concentrating it at one point. The result is two to three times longer life for boom supports and much greater safety.

The new boom supports are especially adaptable to installations where fatigue failures occur adjacent to sockets. They can be easily and quickly adapted to your present equipment because essential dimensions such as pin diameters, distances between ears, etc., are the same as for standard open and closed sockets.

Fatigue-Resistant Boom Supports are an exclusive development of American Steel & Wire Company. Send the coupon for complete information.

VIBRATION EFFECTIVELY DAMPENED HERE over a long section instead of being concentrated at one point.

AMERICAN STEEL & WIRE COMPANY, GENERAL OFFICES: CLEVELAND, OHIO
COLUMBIA STEEL COMPANY, SAN FRANCISCO
TENNESSEE COAL, IRON & RAILROAD COMPANY, BIRMINGHAM, SOUTHERN DISTRIBUTORS
UNITED STATES STEEL EXPORT COMPANY, NEW YORK

American Steel & Wire Company
Rockefeller Building, Dept. C-60
Cleveland 13, Ohio

Please send me complete information on your new Tiger Brand Boom Support Assemblies.

Name.....

Title.....

Company.....

Address.....

City.....State.....

AMERICAN TIGER BRAND WIRE ROPE

Excellay Preformed

UNITED STATES STEEL

THE EARLY BIRD GETS THE LEASE

with the new, improved airborne magnetometer

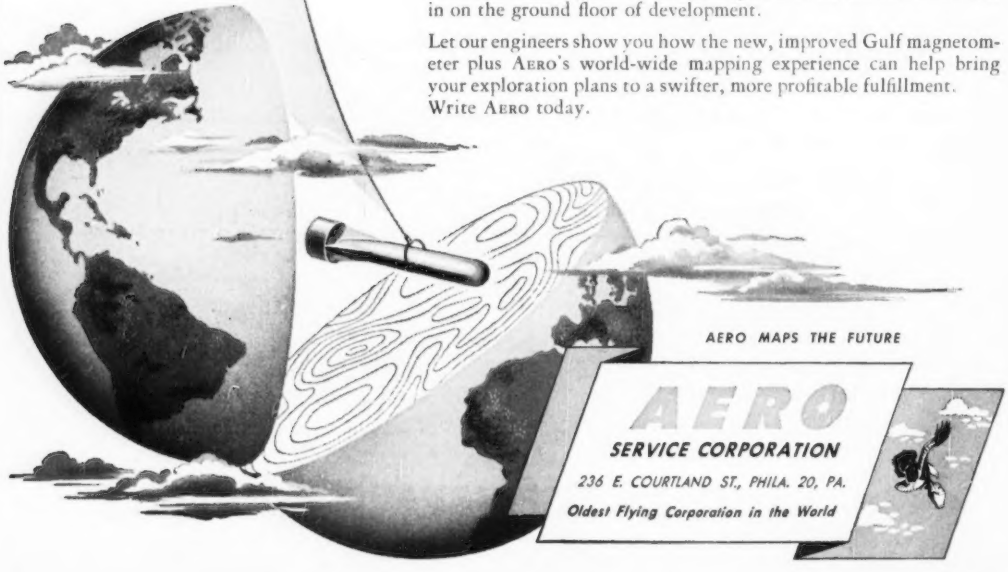
Prospecting has sprouted wings! Today—with precise field data collected swiftly and economically by the improved airborne magnetometer—mining companies can speed their exploration and development programs anywhere in the world.

Perfected by the Gulf Research & Development Co. and field tested by Aero Service, the new magnetometer adds higher sensitivity to aerial magnetic surveying—already the swiftest, least expensive reconnaissance method known. Essentially drift-free and improved in speed of response, this better magnetometer produces maps precise to 1 gamma—the most accurate magnetic maps the world has ever seen. Combined with AERO's detailed photo mosaics, these magnetic maps become invaluable guides in planning your exploration.

AERO's world-wide experience in aerial magnetic mapping brings maximum precision and efficiency to the use of the new, improved airborne magnetometer. For, in the skilled hands of AERO engineers this sensitive instrument will deliver vital intelligence to the conference room at a fraction of the cost and years ahead of ground survey schedules. More important, the information has greater accuracy and detail than possible with conventional ground methods.

Whether you are interested in domestic or foreign minerals, an Aero Service magnetometer survey will expedite your exploration plans. Turn this economy of time into cheaper, more favorable leases. Get in on the ground floor of development.

Let our engineers show you how the new, improved Gulf magnetometer plus AERO's world-wide mapping experience can help bring your exploration plans to a swifter, more profitable fulfillment. Write AERO today.



TOPOGRAPHIC MAPS • PLANIMETRIC MAPS • PRECISE AERIAL MOSAICS • AIRBORNE MAGNETOMETER SURVEYS • RELIEF MODELS • COLOR PHOTOGRAPHY

WICKWIRE ROPE

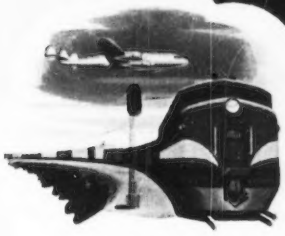
A PRODUCT OF CF&I

Ask any user . . . you'll find them everywhere

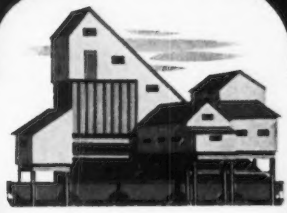
In scores of industries, users of Wickwire Rope have developed an affectionate respect for its performance, safety and long life. And, for true economy, they use Wickwire's WISSCOLAY® *Pre*formed. It lasts longer — is easier to cut, splice and install. It's kink-resistant and safer to handle. Wickwire Distributors and Rope Engineers, in key cities everywhere, are prepared to render prompt service in meeting your wire rope needs. Wickwire Rope Sales Office and Plant — Palmer, Mass.

IN THE EAST—Wickwire Spencer Steel Div. of C. F. &I.
500 Fifth Ave., New York 18, N. Y.
IN THE ROCKIES—The Colorado Fuel and Iron Corp.
Continental Oil Bldg., Denver, Colo.
ON THE WEST COAST—The California Wire Cloth Corp.
1080—19th Ave., Oakland 6, Cal.

LOGGING



TRANSPORTATION

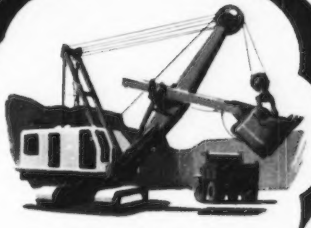


MINING

PETROLEUM

MANUFACTURING

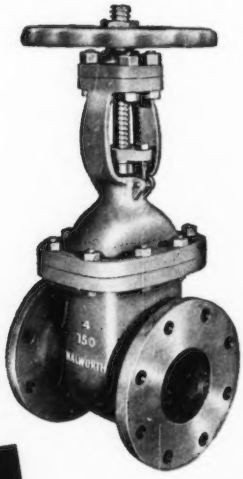
MARINE



CONSTRUCTION

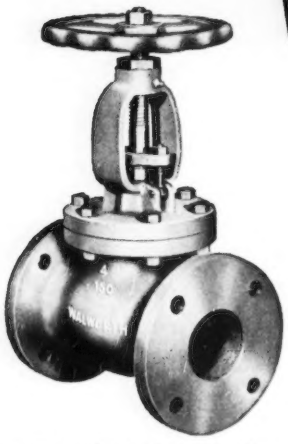
A. E. Brotman

Newly Designed Walworth Valves to combat corrosion



Walworth 150-pound Stainless Steel Gate Valve . . . available in sizes ½ to 3-inch, screwed; ½ to 12-inch, flanged.

Made of Stainless Steel
Monel · Nickel
Acid-resisting Bronze
Ni-resist



Walworth 150-pound Stainless Steel Globe Valve . . . available in sizes ½ to 3-inch, screwed; ½ to 6-inch, flanged.

Sectional view of Walworth 300-pound Stainless Steel Gate Valve . . . available in sizes 2 to 6-inch, flanged.

— ENGINEERED AND TESTED FOR TOUGH . . . HARD SERVICE

Walworth offers a comprehensive line of valves made of several cast stainless steels and special alloys for piping services where corrosion is a factor. These valves are available in Gate, Globe, Angle, Check, and Lubricated Plug types.

Gate, Globe and Angle Valves have outside screw and yoke construction, thus keeping the stem threads out of contact with the corrosive material in the line. They also have a two-piece bolted gland with ball-type gland follower to prevent binding the stem when packing bolts are tightened. Gland eye-bolts can be conveniently swung out of the way without danger of loss when the gland is lifted for repacking.

Gate Valves have taper seats with a unit consisting of two flat faced discs supported by a carrier on the end of the stem. The discs are of a proven ball-and-socket type. They are free to rotate and adjust themselves to the body seat angles, assuring tight seating with no possibility of sticking in any position.

For further information about Walworth's full line of corrosion-resistant valves, see your Walworth distributor.

WALWORTH

valves and fittings

60 EAST 42nd STREET, NEW YORK 17, N. Y.

DISTRIBUTORS IN PRINCIPAL CENTERS THROUGHOUT THE WORLD

Fit Thermoid Quality and Experience into Your Belting Picture

Thermoid high quality stems from continuing research and product development. To complete this picture, your Thermoid distributor and the Thermoid field representative, working as a team, offer you practical experience in solving your particular problem.

Whether it's run-of-the-mill or something "special", your Thermoid distributor can help you select the right Thermoid Conveyor Belt. And the down-to-earth advice of Thermoid field representatives is welcomed by men faced with belting trouble in mining, quarrying and construction operations. They know this advice is the result of day-by-day experience with conditions *in the field.*

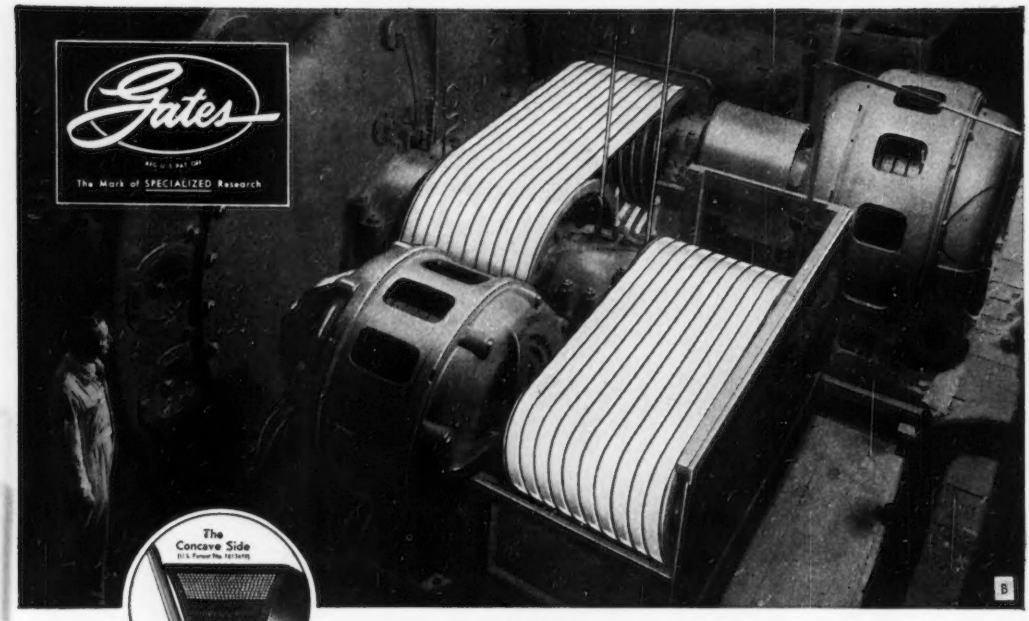
It Will Pay You to *Specify* **Thermoid**

If your belting fails prematurely—if you're stumped with a tough belting problem—call your Thermoid distributor. Together with the Thermoid field representative, he can help you get greater economy, efficiency and tonnage for your belting dollar.

Thermoid Quality Products: Transmission Belting • F.H.P. and Multiple V-Belts • Conveyor Belting • Elevator Belting • Wrapped and Molded Hose • Molded Products • Industrial Brake Linings and Friction Materials.

Thermoid Company

Main Offices and Factory • Trenton, N. J., U. S. A.
Western Offices and Factory • Nephi, Utah, U. S. A.
Industrial Rubber Products • Friction Materials • Oil Field Products



The motor in the background transmits 600 horsepower through a hollow shaft to one impeller of this crusher while the motor in the foreground transmits 400 horsepower to the other impeller turning it in the opposite direction. The Gates Vulco Ropes absorb the terrific shocks encountered when hard copper ores are crushed between these impellers—are not bothered by the dust condition present.

Here is exactly ***WHY*** the Concave Side Saves You Money in V-Belt Costs

When *any* V-belt bends in going around its pulley, it is forced to *change* its *shape.*

Naturally so, because the top of the belt is under tension and grows *narrower* while the body, under compression, *bulges out!*

This change of shape in a *straight-sided* V-Belt, is shown in figures 1 and 1-A—and you will note how the bulging sides press *unevenly* against the V-pulley.

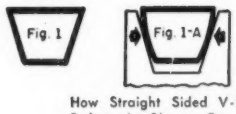
Now look at figures 2 and 2-A. There you see how this change of shape, due to bending, affects the belt that is built with the Concave Side—the Gates Vulco Rope. The precisely engineered Concave Side exactly corrects the side-bulge—and the bent belt *has a shape that exactly fits its sheave groove!*

Two distinct savings result. *First*—There is no side-bulge to cause uneven wear. The sides press *evenly* against the V pulley and therefore wear *uniformly*—resulting in *longer life!* Second—The *full width* of the sidewall grips the pulley—thus carrying heavier loads without slippage—and this *saves belts* and also saves *power!*

When you buy V-Belts, be sure you get the V-Belt with the Concave Sides... the Gates Vulco Rope!

What Happens When a V-Belt Bends

Straight-Sided V-Belt



How Straight Sided V-Belt Bulges in Sheave-Groove. Sides Press **Unevenly** Against V-Pulley Causing **Extra Wear** at Point Shown By Arrows.

Gates Vulco Rope with Concave Side

No Side Bulge. Precise Fit in Sheave Groove. Sides Press **Evenly** Against V-Pulley—Uniform Wear—Longer Life!

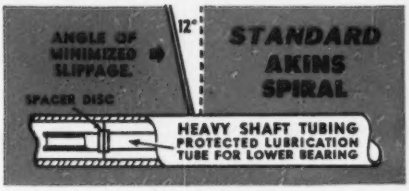
CS-505

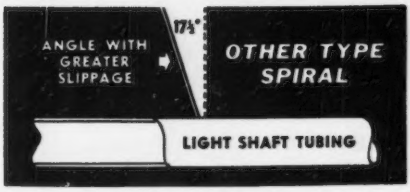
THE GATES RUBBER COMPANY
DENVER, U.S.A.
The World's Largest Makers of V-Belts

GATES VULCO ROPE DRIVES
Engineering Offices and Jobber Stocks **IN ALL INDUSTRIAL CENTERS** of the U. S. and 71 Foreign Countries

WHAT'S THE PITCH...
OF YOUR CLASSIFIER SPIRAL?

This is a partial report of new laboratory tests to determine the effect of pitch on raking capacity of a classifier spiral. Here, briefly, is what it means to your classifier operation.





When A tons were produced by the 12° spiral 0.86 A tons were produced by the 17½° spiral. When B tons (test No. 2) were produced by the 12° spiral 0.57 B tons were produced by the 17½° spiral.

The pitch angle of your AKINS spiral is 12° with the pitch equal to half the diameter. Increasing this pitch by, say 50%, increases the pitch angle to 17½°. Our tests using pitch angles of 12° and 17½° were run under identical conditions in all other respects. The figures give the story graphically. Test No. 2 was run with material having a high angle of repose. Test No. 1 was run with material having a low angle of repose.

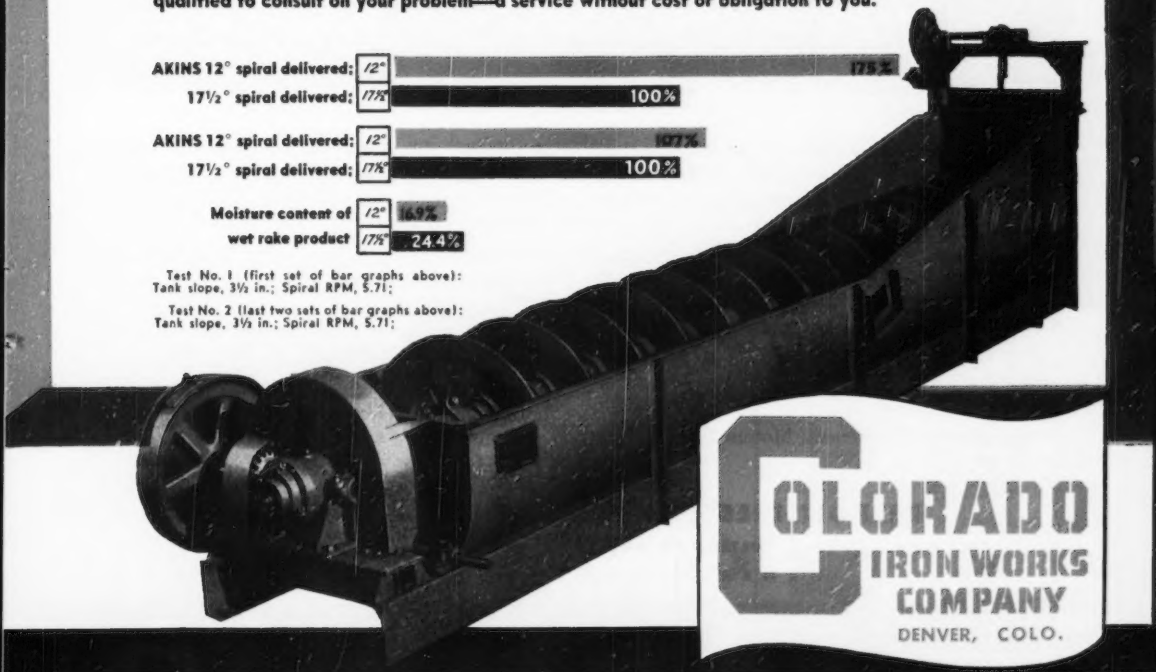
For most applications under normal field conditions, the 12° Akins spiral continues to prove better. As used in the AKINS Classifier, it produces equal or greater tonnage, with lower moisture content in the end product, on less power consumption and with less wear on all parts (based on slippage and abrasion factors).

Be sure you get the raking efficiency your flowsheet demands. Our engineers are qualified to consult on your problem—a service without cost or obligation to you.

AKINS 12° spiral delivered; 12° 175%
17½° spiral delivered; 17½° 100%
AKINS 12° spiral delivered; 12° 107%
17½° spiral delivered; 17½° 100%
Moisture content of wet rake product 12° 16.9%
17½° 24.4%

Test No. 1 (first set of bar graphs above): Tank slope, 3½ in.; Spiral RPM, 5.71;

Test No. 2 (last two sets of bar graphs above): Tank slope, 3½ in.; Spiral RPM, 5.71;



COLORADO IRON WORKS COMPANY
DENVER, COLO.

Manufacturing Representatives: Canadian Locomotive Co., Ltd., Kingston, Ont.; Head, Wrightson & Co., Ltd., Stockton on Tees, Eng.; John Carruthers & Co., (Pty.) Ltd., Sydney, Aus.; Head, Wrightson & Co., S. A. (Pty.) Ltd., Johannesburg; Edw. J. Nell Co., Manila, P. I., Sales Agents. Wright Bros., Credit Foncier Bldg., British Columbia.

DIVIDE BY TWO—
and GET MORE than you had before

FUEL consumption was cut in half and production doubled when a 4-cylinder GM Series 71 Diesel replaced gasoline power in this Northwest one-yard shovel.

The machine handles 1200 tons of limestone and uses only 35 gallons of fuel oil in an 8-hour day, as compared to 600 tons using 75 gallons of gasoline with the old engine. R. W. Meyer, president of Riverview Stone & Material Co., St. Louis, reports moving 400,000 tons of rock without engine overhaul.

"Not only did the General Motors Diesel engine drastically reduce fuel costs," says Mr. Meyer "but operating speed stepped up considerably. This 15-year-old machine walks right through in tight rock now."

Taking jobs like this in stride is everyday work for GM Diesel-powered equipment. The 2-cycle GM Diesel gives lightning response to power demands, operates on low-cost fuel, and delivers long, economical service.

You'll find it pays to specify GM Diesels for repowering old equipment or when buying new. Write us or ask your distributor for details.

DETROIT DIESEL ENGINE DIVISION

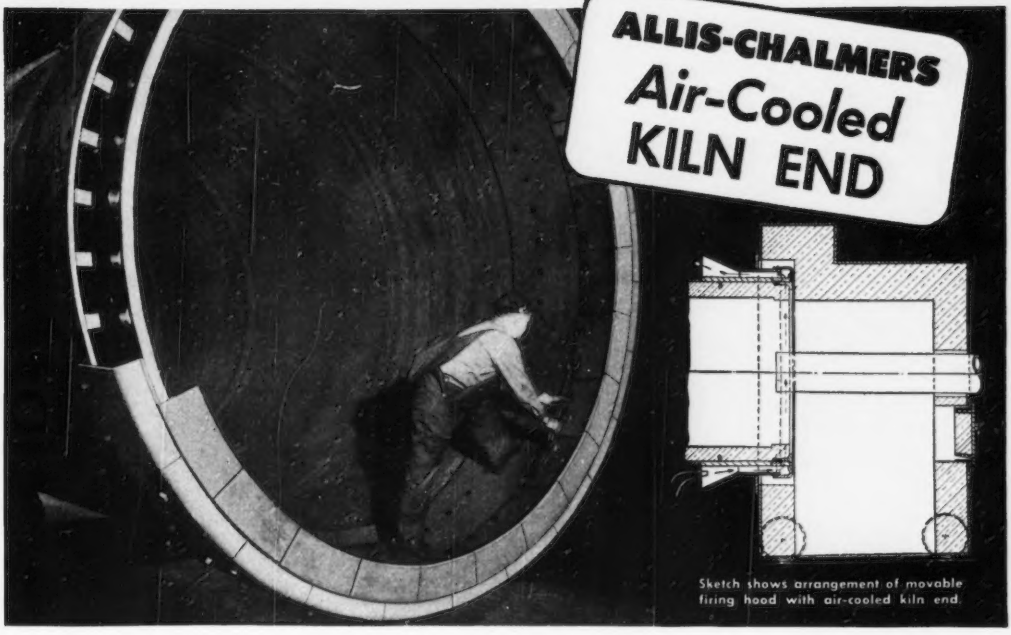
SINGLE ENGINES . . . Up to 275 H. P. **DETROIT 28, MICHIGAN** MULTIPLE UNITS . . . Up to 800 H. P.

GENERAL MOTORS

DIESEL BRAWN WITHOUT THE BULK

GM GENERAL MOTORS DIESEL POWER

Say 'Goodbye' to Nose Brick Troubles with



Sketch shows arrangement of movable firing hood with air-cooled kiln end.

NO SHUTDOWNS for end brick replacement with this Allis-Chalmers air-cooled kiln end. The segmental alloy steel retaining ring, shown above, forms a channel through which a blast of cooling air is forced.

Result: No kiln warpage; refractory brick lasts as long at discharge end as at any point along the kiln.

This one feature alone will, during the working life of the kiln, pay for itself several times over in reduced downtime and increased production... in lower refractory costs and longer life of the kiln itself.

Air-cooled kiln end design makes possible the use of a *more positive* air seal, resulting in fuel savings.

Besides the air-cooled discharge end, Allis-Chalmers rotary kilns are designed and built with a number of other important features:

- **Extra thick shell plate at discharge end and under the riding rings.**
- **Centralized instrument control of the entire operation located on single control panel.**
- **Modern heat recuperation equipment.**
- **Constant delivery feeders and all auxiliary rotary kiln equipment.**

Allis-Chalmers has built hundreds of rotary kilns . . . offers over 50 years' experience in kiln engineering. The A-C representative in your area will put you in touch with these facilities. Call him, or write for **Bulletin 07B6368.** A-2997

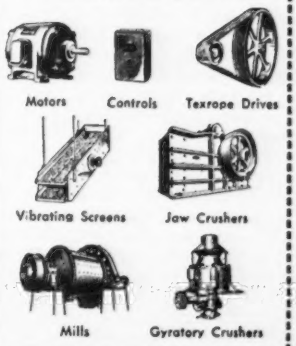
ALLIS-CHALMERS, 969A SO. 70 ST. MILWAUKEE, WIS.

Texrope is an Allis-Chalmers trademark.

ALLIS-CHALMERS

Sales Offices in Principal Cities in the U. S. A. Distributors Located Throughout the World.

"TEAM UP" BASIC EQUIPMENT WITH MOTORS, CONTROL, TEXROPE DRIVES — ALL FROM ALLIS-CHALMERS!



B.F.Goodrich

Why you get more recappable tires when you use B.F.Goodrich

IN TOUGH mining and quarry operations like that shown above, mileage doesn't mean much in measuring tire service. Instead, the yardstick is number of hours a tire works and whether or not worn treads can be recapped, or if sharp, jagged rocks cause serious tread cuts.

Reports from B. F. Goodrich users indicate top performance of BFG tires as compared with other brands. For example, one operator reported over 4,500 service hours from B. F. Goodrich *Universals* vs. only 1,600 hours from another make in identical service.

B. F. Goodrich tires stand out in service for many reasons. Tread rubber is specially compounded to resist cutting. More tires can be recapped because they have double bruise protection in the B. F. Goodrich *double nylon shock shield* . . . layers of nylon cord built in between the tread and the body plies.

Only BFG gives you the added protection of the nylon shock shield; the added savings of (1) longer tire life (2) increased bruise resistance (3) less danger of tread separation (4) more recappable tires. But nylon shock shield costs no extra — you pay no premium!

Another "special" is the new ALL-NYLON tire for tough construction projects, quarry work, strip mining, etc. In all tests, not a single BFG All-Nylon tire blew out, not one flex break occurred!

There's a specially designed off-the-road type B. F. Goodrich tire for every need. See your dealer or write, wire or phone — *The B. F. Goodrich Company, Akron, Ohio.*

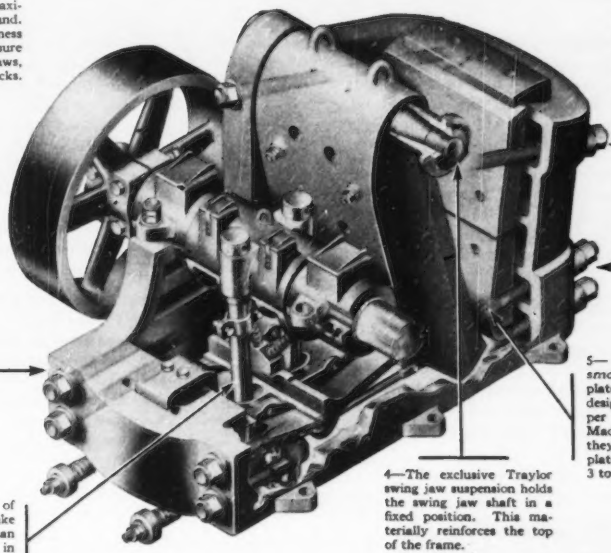
CURVED JAWS...

FOR GREATER CRUSHING EFFICIENCY IN THE TRAYLOR TYPE R JAW CRUSHER

This cut-away of a Traylor Type R Crusher shows clearly the advanced design characteristic of all Traylor-built equipment. Each feature contributes to larger profits through higher production with lower power and maintenance costs. The Type R Crusher, built in five sizes up to 56″ x 72″, is completely described in illustrated Bulletin 123 shown below.

1—The Meehanite* metal frame is of box section design which provides maximum strength per pound. Uniform metal thickness and annealing in sand insure castings free from flaws, shrinkage cracks and checks.

2—Heavy steel reinforcing rods are shrunk in place on each side at the top of the crushing chamber and through the strengthening band at the bottom of the frame.



3—Forged steel rods of extra large diameter make up a very strong pitman which is relatively light in weight.

4—The exclusive Traylor swing jaw suspension holds the swing jaw shaft in a fixed position. This materially reinforces the top of the frame.

5— The *non-chokable, smooth-face curved* jaw plates, of patented Traylor design, keep horsepower per ton requirements low. Made of manganese steel, they outwear conventional plates, often by as much as 3 to 1.

(* Reg. U. S. Pat. Off.)

Write today for your copy of Bulletin 1123. See how curved jaw plates can increase your profits by reducing your crushing costs.

TRAYLOR ENGINEERING & MANUFACTURING CO.
158 Mill St., Allentown, Pa.

Sales Offices: New York, N. Y., Chicago, Ill., Los Angeles, Calif.
Canadian Mfrs: Canadian Vickers, Ltd., Montreal, P. Q.

Traylor

Rotary Kilns, Coolers and Dryers
Grinding Mills . Crushing Rolls
Jaw, Reduction and Gyratory Crushers

A "TRAYLOR" LEADS TO GREATER PROFITS

It certainly takes POWER to Grind Ore

and it's best done in a MARCY Mill

It takes a certain amount of power to grind a ton of a certain ore to a certain size, regardless of mill design. The more power utilized by a mill, the greater the capacity or the finer the grinding. Size for size, MARCY Mills will grind more ore than other types because they utilize the maximum of power and utilize it efficiently. Their low pulp line permits greater impact of the grinding media, quicker removal of finished material with a minimum of overgrinding, and a higher pulp density for better contact between grinding media and ore. This means less floor space, power, and operating labor for a plant equipped with MARCY Mills. That is why MARCY Mills are found in so many grinding plants throughout the world, particularly in large installations.

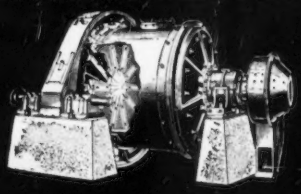
MARCY Open-End Rod Mills, pioneers in fine crushing or coarse grinding—Application of MARCY Open-End Rod Mills to take a coarse feed and, in one pass through the mill, prepare a fine product for the regrind mills is not new. They were doing this in 1919. To the right are a few of the early installations on this work.

As time went on, selective flotation replaced gravity concentration and changed flowsheets for the time being, but MARCY Open-End Rod Mills pioneered in single pass grinding, just as MARCY Ball Mills pioneered in major grinding developments since 1914.

A Few Early Installations	Date
3 Phelps Dodge plants	1919-1920
Cia. Minera Benificiadora de Inde	1921
The Fresnillo Company	1920
Southwestern Graphite Company	1923
Cerro de Pasco	1925
Hollinger Cons. Gold Mines	1923
Neg. Minera de La Mazata	1923
S. F. Mines of Mexico, Ltd.	1925
Bertha Mineral Company	1926
Cia. Minera de Penoles	1926

MARCY BALL MILLS Since 1914 have been world-wide choice for many plants. One of the companies listed (right) recently placed with us the largest single order for grinding equipment ever bought for any plant from any manufacturer! Repeat orders tell the worth of equipment, and many of the companies listed to the right, as well as others not shown, have placed successive orders for MARCY Ball Mills.

- Phelps Dodge Corporation
- Chile Exploration Co.
- American Smelting & Refining Co.
- U. S. Smelting, Refining & Mining Co.
- Kennecott Copper Corporation
- Climax Molybdenum Co.
- American Metals Co.
- Newmont Mining Co.



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NEW GARDNER-DENVER FL2 AIR FEED LEG MOUNTING

Small headings — sub-levels — hard-to-reach stopes — can now be drilled faster — with the new Gardner-Denver FL2 Air Feed Leg Mounting for sinker drills. Weighing only 42 pounds* — the FL2 is easily carried into remote workings — gives your runners these time-saving advantages:

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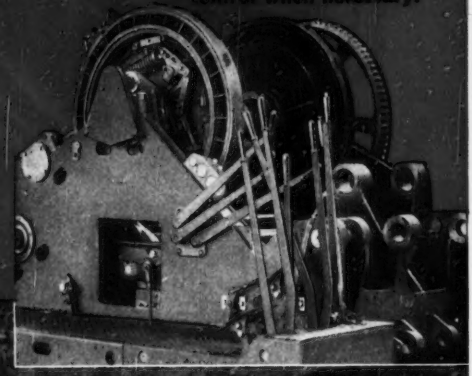
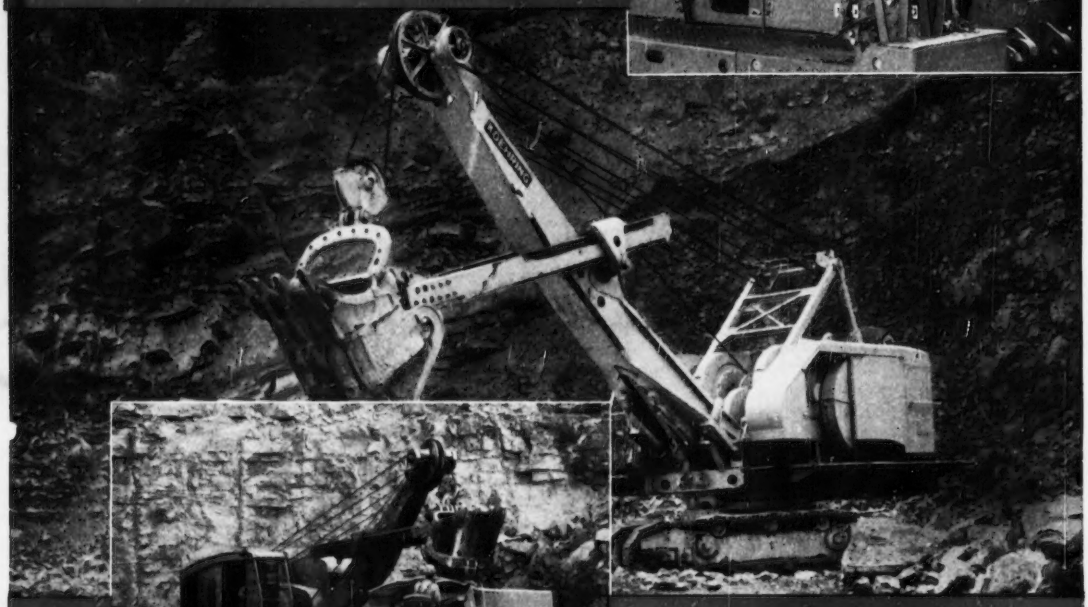
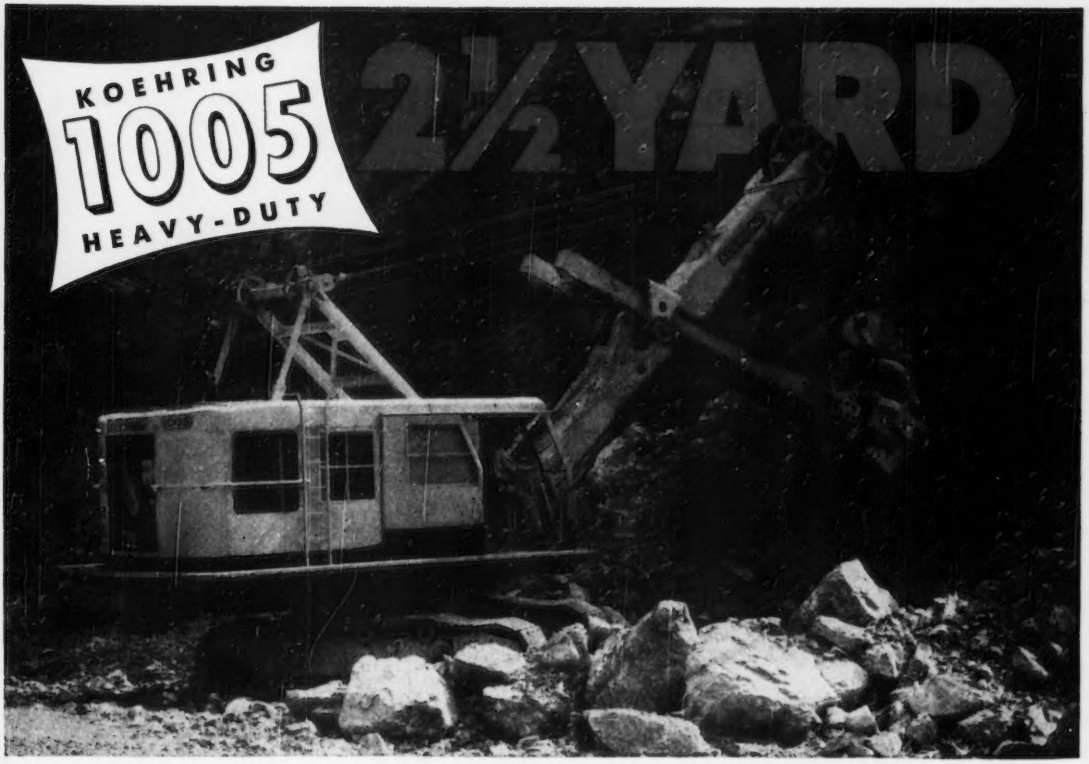
Power-actuated clutch takes only 1/10th the pull required to set a manual clutch of comparative size . . . yet, retains "feel" of load. Heat compensator spring controls power output . . . automatically adjusts clutch for heat expansion. Power clutch easily converted to full manual control when necessary.





ALSO CHECK DUMPTORS® FOR YOUR HEAVY-DUTY HAULING . . . have same, rugged, big-production ability as Koehring excavators (1½-yd. 605 illustrated). Combined, they give you matched excavating-hauling efficiency. Dumptor has 6-yard rock body . . . ton of strength for every ton of payload capacity . . . 3-speed travel, both forward and reverse . . . constant mesh transmission . . . and 5-second gravity dump.



KOEHRING 2½-yard 1005 has plenty of power, stamina and weight-stability to hold solidly when digging into the toughest rock banks. It's *specially-engineered* for heaviest 2½-yard service.

Every operating assembly, from the 1005's cast-alloy crawler shoes to boom point, is extra-heavy-duty to meet the typical strains of 2½-yard digging. Crawler frames and axles are separate units from the carbody . . . provide "give" in the excavator base. Crawlers are easily moved in for shipping clearance. Positive traction-brake steering provides exceptional maneuverability. Center pivot bearings protect vertical traction shaft from horizontal stresses . . . husky hook rollers resist vertical stresses. Compact upper machinery, on one-piece turntable, is simple, accessible.

Big 37", double-band swing clutches are self-equalizing. Clutch housings constantly rotate, dissipate heat, give smooth, cool operation. Entire machine is 100% mechanical . . . no complicated hydraulic or air systems requiring service specialists. Adjustments are easily made by operator.

Operators also like the way the 1005's big, 48" power clutch retains "feel" of load . . . with only 1/10th the normal lever pull. Another Koehring feature, instantaneous dipper trip, works every *time* . . . saves spillage . . . speeds loading for top yardage output.

This heavy-duty Koehring 1005 is diesel powered, can also be furnished with electric motor. Quickly converts from shovel to dragline, clamshell or lift crane. Safely lifts up to 79½ tons . . . boom sections up to 120', plus 30' jib. Other Koehring excavator sizes: ½-yd. 205, ¾-yd. 304, 1½-yd. 605.

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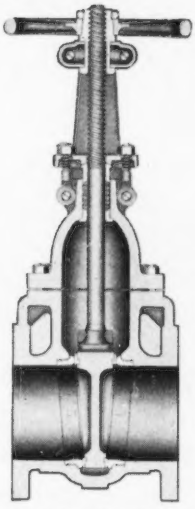

Cross-section, No. 465½ Iron Body Flanged Gate, Brass-Trimmed, Sizes 2 to 12 in. Working Pressures: 125-Pounds Steam; up to 200-Pounds Water, Oil, Gas. Available in larger sizes up to 48 in.

BUILT TO STAY IN SERVICE LONGER

That's what these valves are noted for—long service life with low maintenance cost. Here's why you'll like Crane 125-Pound Iron Body Gates.

Note the stuffing box, for example. Its generous depth assures a tight stem seal and lengthens packing service life. At the bonnet joint, the husky flanges use more bolts to equalize pressure on the gasket. Tie ribs to end flanges give added strength under line strains. In brass-trimmed valves, body seat rings are renewable—don't loosen in service.

You'll find Crane Iron Body Gates easy to operate. Their fully-guided disc seats smoothly and accurately. Crane disc-stem connection and two-piece ball-type gland prevent side strain on stem—there's no binding of working parts. Made in patterns for every need—brass-trimmed or all-iron, with screwed, flanged or hub ends. See No. 49 Crane Catalog.

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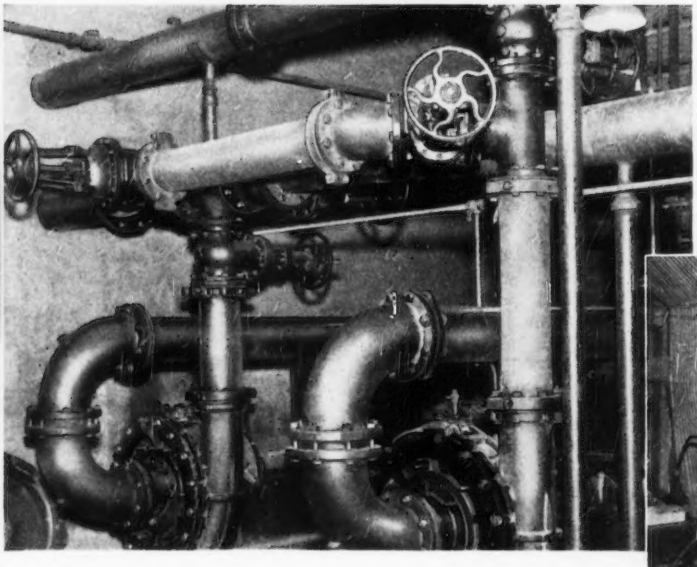
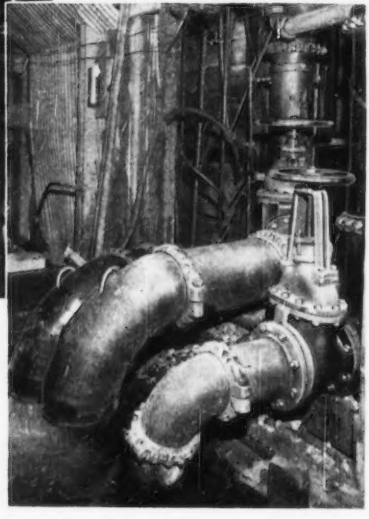


LINES TO SLUDGE PUMPS *in coal breaker plant, equipped with Crane 125-Pound Iron Body Gate Valves and flanged fittings.*

DRAINAGE WATER STORAGE *in a metal mine. Here Crane Quality piping materials give outstanding service under severe conditions.*



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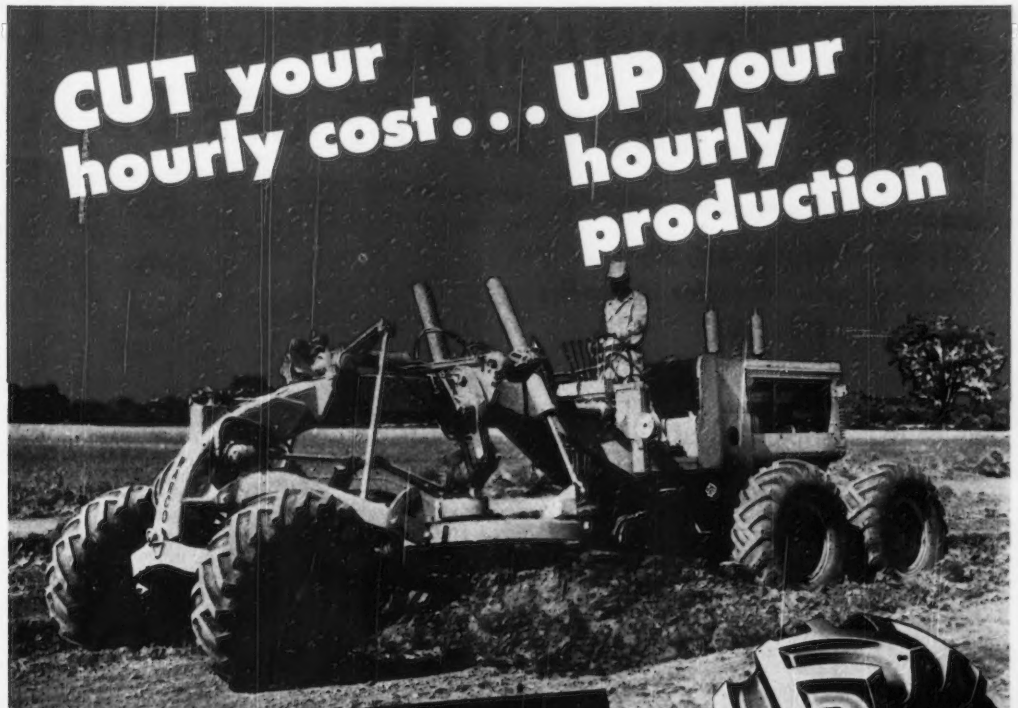

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OFF-THE-HIGHWAY TIRES

ROUND MOUNTAIN MINING PLANT TREATS 17,000 TONS OF ORE DAILY

YUBA builds low-cost, big-capacity plant to handle extensive ore bodies in Nye County, Nevada

Dragline with 7000-lb. scarifying plate, operating from top of bank, works ore down to this 7½-yd. shovel, which loads into hopper topped by a grizzly at end of pendulum conveyor, leading to crusher. Shovel, with 75′ reach, and pendulum conveyor 150′ long, can work circle of 225′ radius around crusher.

Grizzly has bars spaced 30″ apart to keep out outsize boulders, and is hinged to hopper so dragline can dump boulders onto pit floor for bulldozing into out-of-the-way corners. Crusher is mounted on rails for moving further into pit as shovel works forward and down.

To capture the values from extensive ore bodies owned by Round Mountain Gold Dredging Corporation, a new and ingenious method was required. Steep bedrock, ground too porous to hold a dredge pond, and depth of pit (375′ maximum) ruled out the use of bucket ladder dredges.

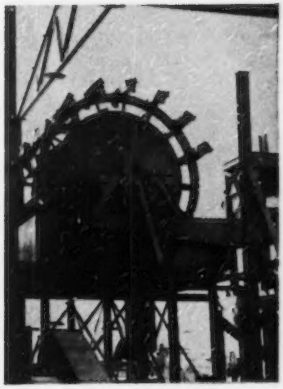
YUBA, under the guidance of Mr. W. C. Browning, Vice-president and consulting engineer of Round Mountain Gold Dredging Corp., developed a plant design that is basically a combination of gravel and open pit methods, plus a dredge treating plant. Briefly, the operation is carried on by a shovel and primary crusher in the open pit; belt to take ore out of the pit to a stock pile; and a conveyor system which carries the ore to the mill. The milling operation combines hard rock practice and that of a placer dredge, and similar equipment is used . . . revolving screen; jigs; gold tables; sand wheels; sand pumps; tailing stacker.

YUBA designed the plant; fabricated about 1,000 tons of structure and machinery, including the conveyor belt system; the crusher and pendulum conveyor; and the treating plant—then erected the plant on the Round Mountain site.

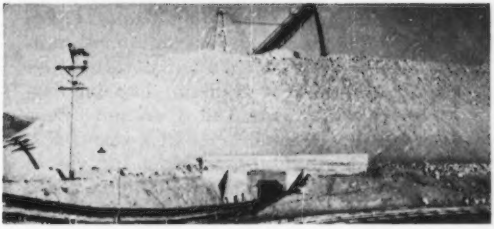
Whether your properties present usual or special problems, you can profit from YUBA's more than 40 years' experience in designing and building plants for the recovery of precious metals. Consult YUBA NOW. No obligation, just write Yuba Manufacturing Co., Room. 706, 351 California St., San Francisco 4, Cal.

Slow-speed pendulum conveyor with 60″ belt, capable of handling large rock, feeds crusher, which is set to crush minus 8″; pit conveyor (42″) carries crushed rock to main conveyor leading to stockpile.

Stockpile end of 2385′ long main conveyor. Conveyor consists of two sections, 42″ wide, with transfer box at the mid point. All belts in the conveying system interlock electrically; system shuts down automatically if one belt fails, thus preventing ore pile-up.



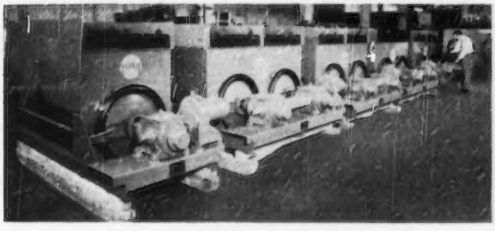
YUBA patented sand wheel—a new, improved type, developed especially for handling sand and gravel on dredges—used to reclaim water and prepare sand for tailings conveyor.



Either one of two feeders, located in the 10'x10'x190' concrete tunnel under stock pile, feeds this 455' conveyor (36" belt) leading to the treating plant. Rate of flow is controlled electrically from the mill. Twin feeders were built into the tunnel, making an alternate available in case one clogs.

This view of treating plant shows similarity to dredge. A 9'x50' revolving screen (upper left) separates gold-bearing fines from coarse over-size. Screens re-size fines into coarse sand and very fine sand, which go through YUBA rougher jigs, gold tables, cleaner jigs, ball mill, classifier, and amalgamation circuit.

Treatment plant, showing 250' thickener tank in foreground and tailings in background. This plant is basically a fixed, dryland dredge, capable of treating 17,000 tons of alluvial ore each 24 hour day.



YUBA jigs used in Round Mountain treating plant are similar to those built by YUBA for placer dredges. Hutch water and jig action can be controlled closely to suit gravel. Screens are stainless steel—no rust, constant full openings.

YUBA MANUFACTURING CO.

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YUBA DREDGES

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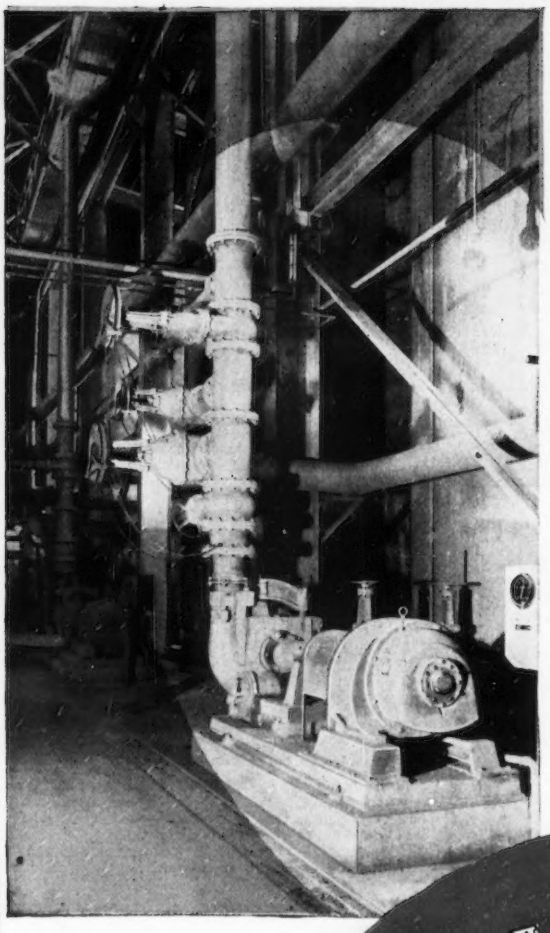

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In every plant where slurries, sands or slimes must be handled on a cost-reducing basis, WILFLEY sand pumps can meet every requirement with a comfortable margin of reserve capacity. These famous pumps deliver continuous, trouble-free performance without attention ...stepped-up production...actual dollar-savings in power and operation. There is an economical WILFLEY pump size for every pumping problem. Individual engineering on every application. Write or wire for complete details.

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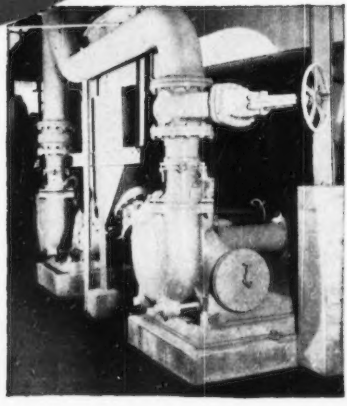

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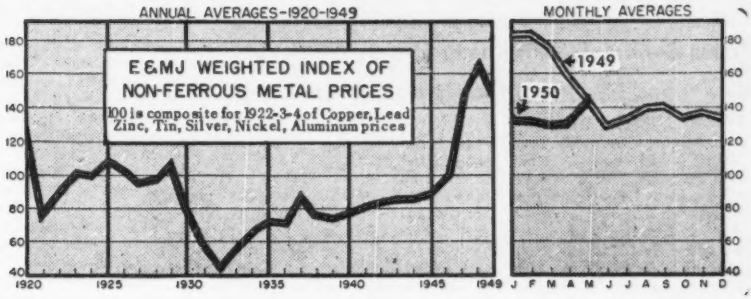
E&MJ OUTLOOK

PRICES



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MARKETS

The boom in general business gained strength in May, with the Federal Reserve index of industrial production moving up to 192, only three points under the postwar peak of November, 1948.

With non-ferrous metal prices following suit, the E & M J index jumped from 134.04 in April to 142.02 in May.

Price gains for May were: 1c per lb. for copper; 1c for lead; 1¾c for zinc; 1½c for tin; ½c for aluminum; 8c for nickel; 1c per oz. troy for silver. All these have put not the slightest brake on consumers' demands.

●

LABOR

Death of Congressman Lesinski moves up Graham A. Barden (Dem., N. C.) into the chairmanship of the House Labor Committee. He's a Dixiecrat, an arch-enemy of the Truman Fair Deal. Any pro-labor legislation coming from his committee hereafter will be over his parliamentary corpse.

●

AT HOME

How long will the boom last? No one could give a flat answer to that one. Yet here are some significant indicators:

Fabricators shipped 124,032 tons of copper in April, but probably an even greater tonnage was used up. There's no inventory-building here.

Zinc's rise is spurred by a concentrate shortage that seems likely to last for some time. Mines can't shift gears fast enough to liquidate the shortage soon.

Hard goods manufacturers are doing a land office business, and steel is almost an under-the-counter item once more.

New construction soars on, with actual black markets developing in lumber and some other items.

There are so many new factors in the picture, however, **that nobody knows what to call normal any more.** It doesn't seem possible that present metal consumption rates can be sustained. On the other hand, Government, facing a deficit and the world situation, will use drastic controls to fight off a bust. But between boom and bust levels, much can happen to particular industries. **It's a time to act cautiously,** but with an open mind.

Don't look for benefit from capital gains tax revisions. The Administration is dead set against this sort of relief to taxpayers.

●

ABROAD

MacDonald Mines' easy-to-reach ore (Quebec, Canada) will feed a trial run of Noranda's process to get iron sinter and native sulphur from pyrite. If it works, Noranda will go after its own huge, but deep, orebody.

India's and Pakistan's hoarders are still paying up to $66 per oz. for gold, the highest rate outside the Iron Curtain. More than 500,000 oz. have been smuggled into these countries in the last six months.

MARKETS—Trends and Prices

Metal Prices Continue to Rise as Producers' Stocks Shrink —Aluminum and Nickel Join in Upward Movement

HEAVY DEMANDS and rising prices featured operations in major non-ferrous metals during May. The E & MJ index of prices advanced 7.98 points to 142.02, the highest level since last September. Copper and lead each advanced 1c. a pound; zinc 1¾c.; and tin 1⅝c. Nickel jumped 8c. a pound on the last day of the month because of "major cost increases." Aluminum joined in the rise by moving up one-half cent a pound, the first upturn in the light metal since October 1948. Quicksilver maintained its reputation of being in a class all by itself, the price declining $1 per flask.

Industrial activity in the United States continued to expand. Preliminary estimates indicate that the Federal Reserve Board's index for May is likely to rise to 192% of the 1935-39 average, only three points below the postwar peak of November 1948.

Production of steel continued at record levels. The operating rate of the steel industry averaged more than 100% of capacity and output in May probably established a record exceeding 8,500,000 tons.

Danger of a work stoppage at plants of General Motors ended when the company and the union signed a five year agreement involving wages, pensions and health insurance. Automobile production in the United States and Canada in the first four months of 1950 averaged around 560,000 cars and trucks a month. Building operations continued at a fast pace. The activity in these key industries has been the main support of the market for non-ferrous metals. Purchases for the strategic reserve has influenced bullish sentiment in both copper and zinc. Lead buying for the stockpile has moderated appreciably.

Copper at 20½c., Valley

With demand for copper in this country in excess of the available supply, tension over the price situation continued all month. The price advanced 1c. a pound on May 18, establishing the quotation at 20½c., Connecticut Valley. Bids were in the market for several days preceding the rise at even higher prices. On May 17 there was a sale of a fair quantity in the export market at a premium over the 19½c. f.a.s. N. Y. basis which may have been a factor in lifting the domestic quotation on the following day. Except for the struggle over the import duty, most observers agree that the rise would have occurred earlier in the month.

In regard to the import duty on copper, the industry is awaiting word from Washington that the House Ways and Means Committee has acted on the Patterson bill extending free entry. As the month ended there was no clear indication on the ultimate fate of the measure.

With stocks of refined copper in the hands of producers down to 57,028 tons on the last day of April, and a further reduction in prospect for May, the statistics are admittedly strong. Deliveries by producers to domestic fabricators during April totaled 101,729 tons, against 123,030 tons in March. Lack of adequate supplies kept the deliveries from rising.

Shipments of products by fabricators during April increased sharply to 124,032 tons, against 106,644 tons in the preceding month. The increase was larger than generally anticipated. Shipments by the fabricating division in the first four months of 1949 and 1950, in tons of contained copper, were as follows:

	Deliveries (Copper Content) 1949	1950
January	109,551	108,921
February	93,474	102,896
March	89,834	106,644
April	65,461	124,032
Totals	358,320	442,493

Stocks of refined copper in the hands of fabricators at the end of April totaled 358,243 tons, which compares with 381,107 tons a month previous and 354,992 tons at the beginning of the year.

Lead Price Raised

Though the demand for lead moderated toward the end of the month, activity in the first three weeks was sufficient to send the price up to 12c. a pound. Stockpile purchases did not figure in the recent buying movement. In view of more than a little uncertainty over the Munition Board's lead program for fiscal 1951, the outlook for the metal was regarded as less favorable pricewise than either copper or zinc.

An Emergency Lead Committee of 21 domestic producers has filed a petition with the Tariff Commission for tariff relief under the escape clause of the Mexican Trade Agreement. The same group has also filed a statement with the Committee on Reciprocity Information requesting that no tariff action on lead be taken at the forthcoming Torquay conference.

During April the domestic refineries shipped 33,751 tons of refined lead to consumers, which compares with 22,358 tons in March. In addition, some 16,000 tons went into the Government's stockpile.

Imports of refined lead in March totaled 18,803 tons, against 21,587 tons in February.

Zinc was marked up sharply, ending at 13c. a pound for Prime Western, East St. Louis. Since early in the year the quotation has advanced 3½c. a pound. Slab zinc stocks in the hands of producers declined during April to 52,520 tons, a total that would indicate that smelters are in a tight spot and the price could easily be raised without running into serious opposition so far as producers are concerned. To make matters worse, the Government has been in the market for second-half 1950 metal for its stockpile. The Zinc Industry Advisory Committee is to meet with representatives of the Munitions Board on June 13 to discuss the supply situation.

The rise in zinc and lead is expected

Average Prices for May (E&MJ Quotations)

Copper:	
Electrolytic, Domestic, Refinery	19.609
Electrolytic, Export, Refinery	19.876
Lead:	
Common, New York	11.721
Common, St. Louis	11.521
Silver and Sterling Exchange:	
Silver, New York, per oz.	72.614
Silver, London, pence per oz.	63.409
Sterling Exchange, "Checks"	279.750
Zinc:	
Prime Western, East St. Louis	11.973
Tin:	
New York Straits	77.495
New York, 99% min.	(e)76.495
Gold, per oz. U.S. price	$35.000
Quicksilver, per flask	$70.346
Antimony, (E&MJ) (d)	27.780
Antimony, bulk, Laredo	24.500
Antimony, in cases, Laredo	25.000
Platinum, refined, per oz.	$66.000
Cadmium, (a)	200.000
Cadmium (b)	207.500
Cadmium (c)	215.000
Aluminum, 99% plus, ingot	17.192
Magnesium, ingot	20.500
Nickel (f)	40.000

Domestic quotations, unless otherwise stated, are in cents per pound. Sterling exchange, checks, in cents. Quicksilver, per flask of 76 lb.

(a) Cadmium average based on the producers' quotation.

(b) Cadmium average based on the average of the producers' and platers' quotation.

(c) Cadmium average based on platers' quotation.

(d) Domestic, 5 tons or more but less than carload lot packed in cases, f.o.b. New York.

(e) Tin contained.

(f) F. o. b. Port Colborne, U. S. duty included.

to result in a larger output of concentrates, the supply of which threatened to become almost as tight as the metal during the second half of the year unless mine output expands. In the Tri-State district the open-market quotation for 60% zinc concentrate has advanced from the low of $55 per ton early this year to $82.50. The price is expected to advance to around $90 early in June, reflecting the jump in metal to 13c. on May 29.

Aluminum advanced one-half cent, establishing the quotation on 99% ingot at 17½c. Higher costs were given as the reason for the rise. The "modest" rise favors aluminum's strong competitive position. Production of primary aluminum in the United States in the first quarter of 1950 totaled 161,438 tons, against 157,957 tons in the same period a year ago. Imports of primary aluminum in the Jan.-March quarter totaled 40,865 tons, of which Canada supplied 40,491 tons.

Nickel at 48c. a pound is about 40% above the average price prevailing in all markets in the prewar years, and compares with 65% to 125% for other base metals, International Nickel Co. pointed out in announcing the higher base price.

Imports of quicksilver have been more than sufficient to take care of the demand.

Tungsten ore was higher on European buying and uncertainty over the availability of supplies from China.

(Continued on page 89)

Major Metals

U. S. DAILY AND AVERAGE PRICES

	Electrolytic Copper (a) Domestic	(b) Export	Straits Tin New York	Lead New York	Lead St. Louis	Zinc East St. Louis
May 1950						
1	19.200	19.425	76.500	11.000	10.800	11.200
2	19.200	19.425	76.500	11.000	10.800	11.250
3	19.200	19.425	77.250	11.000	10.800	11.250
4	19.200	19.425	76.750	11.250	11.050	11.450
5	19.200	19.425	76.750	11.250	11.050	11.375
6	No Market	19.425	76.750	11.250	11.050	11.500
8	19.200	19.425	76.875	11.250	11.050	11.500
9	19.200	19.425	77.125	11.250	11.050	11.775
10	19.200	19.425	77.250	11.500	11.300	12.000
11	19.200	19.425	77.625	12.000	11.800	12.000
12	19.200	19.425	77.625	12.000	11.800	12.000
13	No Market	19.425	77.625	12.000	11.800	12.000
15	19.200	19.425	77.125	12.000	11.800	12.000
16	19.200	19.425	77.375	12.000	11.800	12.000
17	19.200	19.600	77.500	12.000	11.800	12.000
18	20.200	20.425	77.375	12.000	11.800	12.000
19	20.200	20.425	77.500	12.000	11.800	12.000
20	No Market	20.425	77.500	12.000	11.800	12.000
22	20.200	20.425	78.250	12.000	11.800	12.000
23	20.200	20.425	78.375	12.000	11.800	12.000
24	20.200	20.425	78.750	12.000	11.800	12.500
25	20.200	20.425	78.250	12.000	11.800	12.500
26	20.200	20.425	78.000	12.000	11.800	12.500
27	No Market	20.425	78.000	12.000	11.800	12.500
29	20.200	20.425	78.125	12.000	11.800	13.000
30	Holiday	20.425	Holiday	Holiday	Holiday	Holiday
31	20.200	20.425	78.125	12.000	11.800	13.000
AVERAGES FOR MONTH						
May	19.609	19.876	77.495	11.721	11.521	11.973
AVERAGES FOR WEEK						
May						
3	19.200	19.425	76.792	11.000	10.800	11.117
10	19.200	19.425	76.917	11.292	11.092	11.600
17	19.200	19.454	77.479	12.000	11.800	12.000
24	20.200	20.425	77.958	12.000	11.800	12.083
31	20.200	20.425	78.100	12.000	11.800	12.700
CALENDAR WEEK AVERAGES						
May						
6	19.200	19.425	76.750	11.125	10.925	11.338
13	19.200	19.425	77.354	11.667	11.467	11.879
20	19.600	19.954	77.396	12.000	11.800	12.000
27	20.200	20.425	78.271	12.000	11.800	12.333

THE above quotations for major non-ferrous metals are our appraisal of the important United States markets, based on sales reported by producers and agencies. They are reduced to the basis of cash, New York or St. Louis. All prices, except gold and silver, are in cents per pound.

(a) Net prices at refineries on Atlantic seaboard. To arrive at the delivered New England basis add 0.300c. per pound, the average differential for delivery charges.

(b) Our export quotation for copper reflects prices obtaining in the open market and is based on sales in the foreign market reduced to the f.o.b. refinery equivalent, Atlantic seaboard. On f.a.s. transactions we deduct 0.075c. for lighterage, etc., to arrive at the f.o.b. refinery quotation.

Copper, lead and zinc quotations are based on sales for both prompt and future deliveries; tin quotations are for prompt delivery only.

Quotations for copper are for the ordinary forms of wirebars and ingot bars; cathodes are sold at a discount of 0.125c. to 0.15c. per pound.

Quotations for zinc are for ordinary Prime Western brands. Zinc in New York commands a premium over the St. Louis basis equal to the freight differential. Contract prices for High Grade zinc delivered in the East and Middle West command a premium of 1.10c. per pound over the current market for the Prime Western; Special High Grade 1.25c.

Quotations for lead are for common lead. Corroding lead commands a premium of 10 points.

(c) The daily New York silver quotation reported by Handy & Harman is for silver contained in ores and other unrefined silver-bearing materials, in cents and one-eighth cent fractions per troy ounce. It is determined by Handy & Harman on the basis of actual sales of bar silver .999 fine in amounts of 50,000 ounces or more for nearby delivery at New York, and is usually one-quarter cent below the price paid for such bar silver, this deduction being the allowance for carrying, delivering, and marketing. In addition to foreign silver, the quotations also apply to domestic and Treasury silver if such silver enters into the New York market.

The Treasury's purchase price of newly mined domestic silver 90.5c. per troy ounce 1000 fine, effective July 1, 1946. London silver in pence per troy ounce, basis .999 fine.

(d) U. S. Treasury's gold price. Actual payment by the United States Treasury for gold is at 99.75 per cent of the price quoted by the Treasury, which is equal to $34.9125.

Silver, Gold and Sterling

DAILY AND AVERAGE PRICES

	Sterling Exchange "Checks"	Silver (c) New York	Silver London	Gold London	Gold (d) United States
May 1950					
1	279.750	71.750	63.000d.	248s.	$35.00
2	279.750	71.750	63.000d.	248s.	35.00
3	279.750	71.750	63.000d.	248s.	35.00
4	279.750	72.750	63.000d.	248s.	35.00
5	279.750	72.750	63.500d.	248s.	35.00
6	(c)	(c)	(c)	(c)	35.00
8	279.750	72.750	63.500d.	248s.	35.00
9	279.750	72.750	63.500d.	248s.	35.00
10	279.750	72.750	63.500d.	248s.	35.00
11	279.750	72.750	63.500d.	248s.	35.00
12	279.750	72.750	63.500d.	248s.	35.00
13	(c)	(c)	(c)	(c)	35.00
15	279.750	72.750	63.500d.	248s.	35.00
16	279.750	72.750	63.500d.	248s.	35.00
17	279.750	72.750	63.500d.	248s.	35.00
18	279.750	72.750	63.500d.	248s.	35.00
19	279.750	72.750	63.500d.	248s.	35.00
20	(c)	(c)	(c)	(c)	35.00
22	279.750	72.750	63.500d.	248s.	35.00
23	279.750	72.750	63.500d.	248s.	35.00
24	279.750	72.750	63.500d.	248s.	35.00
25	279.750	72.750	63.500d.	248s.	35.00
26	279.750	72.750	63.500d.	248s.	35.00
27	(c)	(c)	(c)	(c)	35.00
29	279.750	72.750	Holiday	Holiday	35.00
30	Holiday	Holiday	63.500d.	248s.	Holiday
31	279.750	72.750	63.500d.	248s.	35.00
MONTHLY AVERAGES					
May	279.750	72.614	63.409d.	—	35.00
AVERAGES FOR WEEK					
May					
3	279.750	71.750	—	—	—
10	279.750	72.750	—	—	—
17	279.750	72.750	—	—	—
24	279.750	72.750	—	—	—
31	279.750	72.750	—	—	—

Calendar week averages: New York Silver: May 6th, 72.150; 13th, 72.750; 20th, 72.750; 27th, 72.750.

(c) No market (Saturday).

Behind the By-Lines...

G. P. Lutjen

» **June is just about as fine as a month can get.** Traditionally the spring has sprung, June brides flourish, golfers stop lying about last year's scores and begin making excuses for this year's scores, and thousands of young men and women leave the sheltering arms of alma mater.

The young fellow on the cover represents the members of the latter group who are going into the mining business. His potentialities are among the industry's most important resources. Though we are inclined to speak of mining as a "wasting asset" business, this man's training is one asset we shouldn't waste.

If you are planning to hire a young graduate for your mine, mill or smelter (and if you're not, maybe you'll change your mind), turn to page 56, where there are some good ideas on how to use young engineers to the best advantage, both yours and his.

» **Biologists and County Agents** aren't the only people privileged to deal in hybrids. Every so often a mining company somewhere comes up with a dilly. If you don't believe it, take a look at the "dry-land" dredge on page 58. Here's an outfit with all the elements of an orthodox dredge working a placer for gold—except that it "floats" on dry land and utilizes an interesting conveyor layout. Offhand this looks like a case of "Don't raise the bridge—lower the river!"

» **All too frequently, otherwise sound plans for cut**ting costs go awry because they make the wage earner very unhappy. However, on page 60, **Phil Angove** and **Richard Latimer** of the Idaho Maryland present a scheme that keeps everyone smiling and reduces explosives costs by 30%. The two pages are a worthwhile investment of your reading time.

» **Geologists sure have their troubles.** This story, related to us recently, concerns one of the minor afflictions.

The field party of a prominent mining company was hard at work last winter when one day they came upon some rock that started the Geiger counter ticking like a two-dollar alarm clock. The boys promptly cut themselves a goodly sample. One of the geologists stowed the uranium ore in his pack sack and headed back for civilization and a laboratory, leaving his fellows to carry on.

After a long and arduous trek he reached a railroad station where he settled down to wait for the east-bound flyer. He wasn't there long when a stranger entered, also equipped with a pack sack. Being friendly fellows, the two were soon engaged in conversation.

"Been out in the bush?" asked the stranger.

"Uh-huh."

"Whatcha been doing?"

With practically no hesitation and even less regard for the awkward truth, our hero replied, "I've been hunting deer."

This occupation left the stranger unimpressed. But a moment later his eyes took on an excited gleam. "Know what I'm gonna do? I'm gonna look for uranium."

It was the geologist's turn to be noncommittal, but the stranger bubbled on. "I've got one of them Geiger counters. Want to see it?"

Somewhat disturbed, the geologist vowed that he had no interest whatsoever in such gadgets and tried to push his loaded pack sack as far away from the embarrassing stranger as possible. But undaunted, the would-be prospector took out his Geiger counter and prepared to give a demonstration. "First," he said, "You have to ——."

He never got any further. With a piercing cry the geologist had jumped to his feet, shouldered his sack of rocks and disappeared through the door, muttering something about a sick aunt in Peoria that he had to see immediately.

» **Last week's mail** brought a copy of the Constitution and By-Laws of "The Turtle Club." According to Article 4, the purpose of the Association is *"To provide contact and association of men and/or women who have had the mutual experience of their lives being saved by the wearing of protective 'hard hats'."*

In other words, if a "hard hat" has at some time or other prevented a serious alteration of the topography of your skull, you're in. However, it is not deemed advisable to go out of your way to become eligible for membership. An objective of the club is to prevent such accidents.

Those people qualifying for membership should submit a *"completed application form, accompanied by a copy of First Aid or Compensation reports, or verification in writing by two others. . . ."* Members receive a scroll and a lapel pin in the form of a turtle. Apparently the turtle is chosen because he is a cautious chap who carries his safety equipment with him at all times. For further details, write E. W. Bullard, 275 Eighth St., San Francisco 3, Calif.

» **If you have a power problem,** crickets are definitely not the solution. This conclusion is based on an item in a recent issue of *The Ohmite News.*

There is something about the chirping of a cricket that affects the human ear out of proportion to the energy produced by the noise. It is reported that when the sound is heard from a distance of several feet, the cricket is generating about 0.000000001 watt. This means that it would take one billion crickets to generate one watt.

» **In this issue, don't miss...** "A New Orebody for Magma?" (p. 112)...a super Geiger counter in the New Products Digest (p. 107)...a torque meter to equalize strain on heavy equipment bolts and rods that you can make in your own shop (p. 92)... another trip Inside Yugoslavia with John Christie (p. 77).

ENGINEERING AND MINING JOURNAL

JUNE, 1950

Last Chance for Tax Improvement

WITHIN THE NEXT FEW WEEKS will be the last opportunity in this Congress to act effectively by urging Congress to heed the six-point tax incentive program of the National Minerals Advisory Council (E&MJ, Mar., pp. 56-59). This will be while the Finance Committee is considering the tax bill that has been held up in the House.

There is no real hope for a tax measure that does not have the endorsement of either the House Committee on Ways and Means or the Senate Finance Committee. It has been evident that the Ways and Means Committee feels that it will have done its stint for mining if it protects percentage depletion allowances from Administration attack. Thus, the real hope for any action on the vital six-point tax program is with the Senate Finance Committee. According to tradition, this committee cannot originate a revenue measure, but it can initiate this program by tacking it on the tax bill as an amendment.

This issue will not die even if nothing is done in the present Congress, simply because the problem of strangling venture capital is so fundamental that the mining industry has no recourse except to continue the struggle. However, if you are aware of the importance of this issue to the industry and are prepared to help, now is the last chance this year to let your members of Congress know that we cannot possibly have a healthy mining industry in the present tax climate.

"Social Security" Is a Myth

THERE ARE THREE FACTS about the program, which masquerades under the title of "social security," that every person who is compelled to contribute to this program ought to know.

The first is that this program is designed to increase the tax on payrolls to 6½ percent or more by 1970. Half of this, as at present, will be chargeable to employees and half to employers. This of course involves tremendous sums, more than business owners in general receive as dividends and more than the average wage earner is able to save. In short, we are headed for a situation where the Government will commandeer most of the savings which thrifty people used to be able to lay by.

Second, these savings that the Government extracts from most of us are not necessarily being conserved for the people from whom they are taken. Even though a retired wage earner contributed to the program since its inception, he is denied his natural right to enjoy the benefits if he is dissatisfied with trying to live on the miserable sum that is his due and earns a small additional amount. Despite this defrauding of the contributors, the Government does not hesitate to hand out benefits to any kind of people over 65 who earn nothing, even though they never contributed to the program in their younger years.

Third, the Government is not protecting the integrity of the enormous sums in its custody for alleged social security. We do not here criticize the practice of using the money and simply depositing IOU's for it, as the Government, being the source of money, cannot do anything else.

But to protect the integrity of these deposits the Government has what should be considered a sacred responsibility to live within its means and to improve its fiscal position each year by the amounts represented by the net "take" under "social security." Only by such a policy can the wage earner be assured that he will get his benefits, if any, in the same kind of dollars that were extracted from him and from his employer.

When the Government plunges into deficit financing, or despite these contributions, merely breaks even, it is assuring the wage earner that the dollars he will deserve after retirement will buy less than those taken from him. In other words, it practices a swindle for which an individual would, and ought to be, put in jail!

To protect themselves, the contributors to the "social security" program ought to:

1. Demand a lower ultimate tax.
2. Insist that benefits be based on contributions and be inalienable, regardless of earnings after age 65.
3. Require the Government to cease deficit financing and improve its fiscal position in consonance with the net "take" from industry and wage earners for this purpose.

Why The Mining Industry Should Employ More Trained Talent Now

E&MJ'S COVER shows one of the hundreds of engineering students who will graduate this year and try to find a useful place in the mineral industry. Like many others he has deferred his education to serve in the Armed Forces. Hence the number of G.I. graduates added to the normal number of engineering graduates has produced a bumper crop this year. This will make it harder than usual for the engineer shown here and many other like him to find a job.

Thus far the mining industry has not demonstrated any outstanding willingness to absorb this available talent. Accordingly, this is an opportune time to point out that the industry needs the services of these young men as much as they need an opportunity to serve the industry. Here are the reasons:

1. Management is overburdened with problems involving higher costs, labor, taxes, government regulations, etc., and these problems will become more acute in the future.

2. The obvious solution is to spread the load on more shoulders and to train second and third-string staffs to assist in management tasks.

3. For future planning, the most logical place to look for this assistance is among the present and past graduates of engineering schools.

4. One of the wisest and most profitable moves our industry can make today is to invest heavily in engineering talent for development and research projects.

Perhaps you will challenge this last point. We hope so, because the purpose of this article is to prove that research and development work pays, that the industry should hire more talent for this work, and that engineers as a whole should be employed more effectively.

It should be hastily added that an appreciable number of mining companies have already set up successful research and development programs. To cite a few, these include International Nickel Co., Climax Molybdenum Co., Anaconda Copper Mining Co., Tennessee Copper Co., Hudson Bay Mining & Smelting Co., Combined Metals Reduction Co., and others. Nevertheless, there is plenty of room for others to get on the bandwagon of accelerated progress, and those which now have research and development programs may find it profitable to expand them.

The most compelling argument in favor of development and research is that it pays in dollars and cents. Examples are legion, but here are a few to emphasize this point:

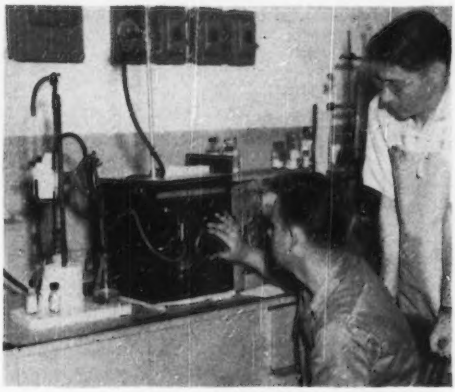
1. Under the supervision of Ralph Neyman, the Sullivan Mining Co. staff concentrated on 10 mining details including compressed air transmission, bit performance and costs, drill repairs, powder handling and size of drill hole. As a result, drilling and blasting costs per ton were reduced from $0.7040 in 1945 to $0.4940 in the first half of 1949.

2. One large mining company, planning a multi-thousand-ton mill, was faced with the almost unescapable fact that it would have to grind to 325-mesh to recover values in the ore. However, after 2½ years of research, it found that it could increase the size of flotation feed from 325-mesh to 65-mesh, and cut about $1 million from the anticipated cost of the mill.

3. Engineers of Golden Manitou Mining Co., Ltd., in Quebec figured that they could increase mill recovery by adding eight flotation cells. As a result, zinc recovery jumped from 84% to 89.7%; gold from 77.9% to 82%; silver from 65.4% to 78.8%; and lead from 64.2% to 78%. The added equipment will pay for itself in less than a year.

4. U. S. Smelting Co. believes in research engineering. Weekly staff meetings are attended by managers, operating staffs, and research engineers at its Western mines and

(*Continued on page* 58)



RESEARCH ENGINEERS of Tennessee Copper Co. at work on milling problems. See E&MJ, Nov., 1947.

How Management Can Profit by Using Research

TENNESSEE COPPER COMPANY'S operation at Copperhill, Tenn., is well-known for its achievements in advanced milling techniques. So we asked Jack Myers, mill superintendent, what part engineering and research played in technical accomplishments now in evidence at the property. His answer was most convincing. Here it is:

"About your letter of the 13th. True it is that we carry a larger group of engineers than other mills our size.

"Back in the old days when copper concentrate was the only product from milling, the Tennessee Copper Co. was a dollar swapping business and on the verge of always going broke. It was only by a long-range plan of study and research that the waste products were developed into commercial products, namely zinc concentrate and iron concentrate from which a premium grade sinter is made.

"So over the years we have become so imbued with the value of research that we no longer know how to get along without it, for the simple reason that once the human mind is stimulated to be unhappy over lack of knowledge of why things happen, then the problems to be solved are endless.

"Our research staff is composed of six graduate engineers in addition to Lewis and myself. These are backed up with five high school graduates and a clerk to do the book and record work. This does not include assayers and chemists on analytical work.

"I see no point in using highly trained engineering graduates to do the work that lesser trained men can do, and for this reason I always hire high school men to help the technical men. I know many supervisors think that engineers should be put on sampling, screen analysis and other menial work, presumably to discipline their souls or something. With help, the engineer can make a far better showing if he does not have to spend a lot of his time doing the lesser things. This system quickly screens out the young engineers who cannot take responsibility and are misfits; and those who can take it are encouraged with more responsibility.

"Likewise, I think supervision should be generous in providing top-notch equipment for research work. I have to swallow quickly every now and then to put up the money my staff asks for, but if I hold them to accomplishing results, then how can I hold back on getting them what they need to do this?

"I think that many supervisors are unfair to young engineers in that they expect too much from them. Blocking out the research work and contributing to the young fellows' efforts definitely is a responsibility of supervision. The problems must be given to the young fellows in a clean-cut fashion.

"Currently we have a long list of things we don't know about. Lots of other plants have the same problems, but not knowing that they don't know, they are happy to get along with what they have.

"At the moment, the chemical aspect in the grinding circuit is our major activity. We reported at New York [AIME Meeting] a substantial saving in reagents. For the first quarter of this year the reagent saving was $5,400.00 less than we budgeted, and the 33% reduction in flotation time still holds.

"We have one man trying to perfect the technique of using the bubble machine to replace the inadequate conventional laboratory flotation machine. Another is attempting cathodic protection on grinding balls and incidentally the experts give us little or no encouragement on this work.

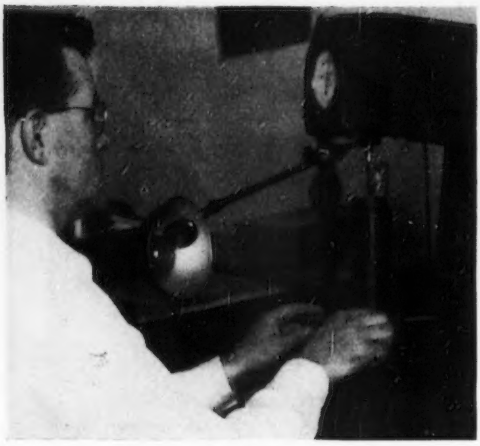
"We are not satisfied with our knowledge on how sodium silicate functions, nor do we know just what is the role of cyanide in our copper float. Certainly there is no adequate flotation machine on the market. We have not gone far enough with developing automatic control. The list seems endless. Nevertheless the results keep getting better, and this justifies expenditure for research by management.

"For the past two years our tricone and hydroscillator have taken up most of our time. This cut our operating cost pretty close to 10c. a ton, and greater gains are possible.

"I keep one engineer entirely on the mechanical studies of the operation, and this pays its way nicely.

"Now you can use any part of this letter for your article on one condition, and that is **that you quote us as being 100% in favor of Prof. Taggart's viewpoint on engineering education as expressed in his recent article published in Mining Engineering.** (April, 1950, pp. 460-462). The problems of beneficiation are going to be solved by students well grounded in the sciences. It is up to industry to train them in detail matters of operation.

"Sincerely yours, Jack"



J. H. NILES, of Lake Shore Mines mechanical department demonstrates equipment used to check hardness of rock bits.

QUEBEC MINER, working with mining engineer as observer, tests performance of new lightweight rock drill.

smelter. As a result of efficiency studies made by these groups, the company adopted new mechanical methods to perform clean-up and materials handling jobs in mine and plant yards. It is estimated that one $15,000 fork-lift straddle combination which transports mine timber, pipe, and rail will pay for itself in about two years by savings realized in timber handling alone.

The foregoing examples from recent articles and editors' notebooks indicate that cost-cutting is virtually an open field in the mining industry if companies will only hire and train more engineers to carry the ball. For eloquent support of this conclusion, we refer you to the opinions of Tennessee Copper Co. and Climax Molybdenum Co. as set forth separately in this article.

Mining is traditionally regarded as a wasting-asset industry. This introduces a second argument in favor of more intense research because the wasting-asset obstacle can be overcome by foresight and planning. If a mining entity is to perpetuate itself, it must find more ore, acquire new properties, develop economic methods to recover marginal ores, or diversify its activities. Each of these solutions requires resourcefulness and imagination coupled with good business judgment, i.e., research under the direction of management. As excellent examples of diversification we might point to Kennecott Copper, New Jersey Zinc and National Lead companies, all of which are in the titanium business; to Climax Molybdenum Co., which is now in the uranium business; and Sunshine Mining Co., which is showing interest in Canadian oil projects. The diversification trend in mining is more pronounced today than ever before, and it means that companies will have to hire supplementary engineering talent or train it.

In formulating a research and development program, the following suggestions may prove helpful:

How big should the program be? One way to approach this question is to total up your mining costs, including freight and smelter penalties. Then assume that you can save 5% of this, to be on the conservative side, and estimate how much you can afford to spend to make this saving. Bear in mind that most savings accomplished through research continue year after year.

This may mean that you can afford a whole department, or it may justify part time work by one man alone, depending on how large your operations are. In any program, the steps are the same. 1. Develop a healthy dissatisfaction with the way things are being done. 2. Assign the responsibility of finding out or developing better ways to some department or individual. 3. Test these ideas for practicability and economy. 4. Put them into action.

Don't repeat work that someone else has already done. This applies especially to the little operator because he can always find out what is being done by reading the vast amount of useful technical literature now available. Most large companies with well organized research departments have long learned the value of going through technical literature with a fine-toothed comb and applying what they learn.

It simply won't do to expect engineers to do a comprehensive job of reading on their own time, nor is it wise. The proper way to handle this detail is to require one or more staff members to study current technical literature on company time. Then require them to make regular reports on all developments applicable to their work. (This often requires imagination and ingenuity.) Finally recommendations should be made and cost estimates submitted. Management can then weigh the logic of the engineer's reports and estimate whether the projects will pay.

One other way to take advantage of other people's efforts is to extend a standing invitation to technical men to visit your plant and to give your engineers a chance to visit other operations and come back with reports and recommendations. Those who have tried this system know that it pays.

Who is qualified to do the work? One manager in charge of research and development projects for a large metallurgical concern tells us that he classifies engineering employees as follows: "Wheelhorses and idea men." The "wheelhorses" are the fellows who are more content to do routine work. These are the fellows who are happiest when they are working on such assignments as survey projects, assaying, or other routine engineering work.

RESEARCH IN THE SMELTER

GEORGE McKERROW, assistant metallurgist at Noranda, is checking on two recent projects. (1) Measuring air flow to converter at left, and (2) adjusting automatic flux feed to converter, right. Additional projects will follow.

Planning and Research Cut Costs at Climax

CLIMAX MOLYBDENUM CO. is also widely recognized for its advanced policies, and its management believes in research and planning. The following report prepared by Franklin Coolbaugh, assistant general superintendent, shows how this work pays:

About two and a half years ago Climax Molybdenum Co. set up a planning department to investigate those plant operations in which costs could be cut or operating results improved. This work involves research as well as cost and operation analysis in many instances.

Major problems tackled by the department to date include: power problems, including distribution, costs and peak loads; tests on detachable bits and drill steel; mine sampling methods; slushing methods and improved slusher hoist design; guniting methods and equipment; improved domestic water supply sources for the camp; and methods of cutting down underground compressed air losses.

When time is available many other problems will be studied, including, central high pressure steam heating for all plant installations, blasting methods, and methods of allaying dust on tailing ponds.

Obviously this department could not be supervised by inexperienced personnel. Consequently the company transferred key personnel from one department to Planning Department Head after a training period in operating problems of other departments. The department has employed as many as 6 men when it was necessary to check operating data on three shifts. Sometimes only two are required. Whenever extra men are needed, they are transferred from the engineering department. This training has benefited both the young engineer and the company.

Here is an example of what the planning department has been able to save for the company by reducing peak loads and power consumption: After approximately six months of initial studies and manipulations of power uses and peaks, the overall power bill has been reduced as much as $5,500 per month on an equal production basis.

The first step consisted of making power readings and recording power peaks of the totals of individual departments over each 24-hr. period. This was done for two months. On the basis of these findings peak load demands were reduced by controlling department operations as a whole. This resulted in considerable savings on a preliminary basis. In further detailed studies within each department, every piece of power consuming equipment was studied, metered and analyzed, either as a unit or in small groups. This provided the final basis for operating changes resulting in maximum savings and efficiency. After factual data was gathered, the department heads made the necessary changes and adjustments to reduce power consumption and peak loads. On the overall tonnage handled, consumption figures were reduced as much as 3.3 kwh per ton.

To hold these gains, 24-hr. kwh-meters were permanently installed at all points where operating changes or lack of proper attention would effect over-all peaks and consumption. In this way department supervisors can check power efficiency obtained in their sections.

When candidates exhibit these tendencies, they are assigned to the kind of jobs they perform best. On the other hand, there are also "idea men"—those who are always coming up with suggestions on how to do things better and who are gifted with imagination and initiative.

While the mining industry has always recognized the importance of routing engineering jobs like sampling, surveying and ore testing, it appears that it would be wise to divert more talent from the "wheelhorse" class to the "idea-man" class as an incentive for those now in engineering work who are capable of developing new ideas.

HERE'S THE RECORD — Comparison of Powder Costs per Cu. Ft. Broken

Year	Cu. Ft. Broken	POWDER CONSUMPTION: Lb. Powder	POWDER CONSUMPTION: Cu. Ft. Per Lb. Powder	COSTS: Explosives	COSTS: Per Cu. Ft.	COSTS: Per Ton
Before Powder Plan Was Adopted						
1948	2,780,000	585,190	4.75	$71,605.00	$0.0258	$0.31
After Powder Plan Was Adopted						
1949	2,450,474	329,250	7.45	$43,950.55	$0.0179	$0.20
SAVING in cost per cu. ft. of rock broken					$0.0079	

TOTAL SAVING FOR 1949: 2,450,474 × 0.0079 = $19,358.74.

Idaho Maryland's Powder Plan Cuts Explosives Cost by 30%

. . . and they expect to do still better. Secret of the plan is to make leasers cost conscious. Now leasers are sold on the use of stemming, spacers, smaller drill holes, and better-planned rounds. Results are powder savings for the company and better earnings for the leasers.

PHIL ANGOVE[1] and RICHARD LATIMER[2]

BEFORE

THE SITUATION THAT EXISTED at Idaho Maryland Mines Corp., Grass Valley, Calif., before the management adopted a plan to sell explosives to contract miners on Jan. 1, 1949, was as follows:

Even though the State law required the use of non-combustible stemming underground, workmen did not comply. They would not carry heavy mud tamping over muck piles or into stopes unless directly supervised. Later lightweight stemming material was supplied, and campaigns were waged by bosses and safety engineers to stress the advantages of better detonation and less gas in the muck piles. But still the miners were lax in using the tamping, and powder consumption remained high.

Furthermore, miners habitually overloaded holes. If five sticks would break a hole, why wouldn't eight be better—that is, of course, as long as the company foots the powder bill. In a 7x5-ft. heading, a 6-ft. round of 30 holes was loaded with 300 sticks of powder to break a five-finger burn cut. As long as the company supplied the powder, why economize? In fact, it was common practice to let surplus powder lie around in working places rather than return it to the magazine. Excessive loading meant cut-off holes resulting in powder in muck piles and chutes.

How the Powder Plan Was Put into Effect

Obviously the only way the company could obtain powder economy was to give the miners some incentive to economize. This meant selling powder to company miners. But before such a plan could be adopted, two problems had to be solved:

1. An effective control of underground powder distribution.

2. A method of pricing the powder which would benefit both the miner and the company.

1. Powder Distribution

This problem was relatively simple because Homestake Mining Company had been selling powder to their miners for many years. They very generously gave us an outline of their underground distribution system which we adapted to our needs. The tool nipper or supply man was made responsible for receiving powder in the magazine and distributing it to the miners. All magazines are locked. One key is held by the powderman, one by the shiftboss, and one is kept in the foreman's office.

Powder is charged out on a daily report which is turned in to the boss at the end of the shift. From this report the mine clerk charges each contract with the number of sticks used. At the end of each two-week contract period, the contract engineers make an inventory of each magazine. This inventory is checked against the daily powder

[1]Safety Engineer and [2]Clerk for Idaho Maryland Mines Corp., Grass Valley, Calif.

issued by the powder man. A form for the two-week contract period is then made out by the safety engineer showing (1) location of magazine; (2) powder on hand at start of period; (3) powder received in the magazine; (4) powder on hand at end of period; (5) powder used; and (6) the difference. This report is given to the mine superintendent, and if a shortage of more than a few sticks exists in any magazine, a check is made and the error corrected. Finally, on the 25th of the month, the safety engineer makes a physical inventory of all magazines, and this inventory is checked with the warehouse man in charge of the main surface magazine.

2. Pricing the Powder

Pricing the powder for sale to the contract miners was more difficult, however. We had no precedent and were pioneering. To minimize resistance to a new idea, we felt that the pricing method had to be just right from the start. We finally decided to allow the contract miners an increase in their contract rate and to deduct the cost of powder used from contract earnings. After considerable work a formula was developed along the following lines. All contract measurements and calculations are based on a linear foot or cubic foot basis. Therefore, powder sales price could best be figured by relating it to cubic feet broken under various mining conditions. The following example illustrates the method followed.

Stoping costs during the six-month period preceding inauguration of the procedure totaled $38,-934.46. Of this, powder costs amounted to $20,001.83, or 51.4%. During the same period the contract breaking price for an average 4-ft. stope was $0.042 per cu. ft., giving a unit powder cost of 0.042 ×51, or $0.022 per cu. ft.

From watching lesser powder economies we concluded tentatively that over-all powder consumption could be cut one-third. Based on the preceding figures, this would require a reduction in average stoping powder costs from $0.022 to $0.015 per cu. ft. broken. Unit cost in drifts, raises, and crosscuts were figured in the same manner.

Stick cost to the miner was determined as follows: The total explosive cost for 1948 was taken, including the cost of powder, caps, labor making primers, warehousing, and handling explosives. This cost was then broken down on a stick cost basis, which was $0.065 per stick. All powder is sold by the stick rather than by the pound. It would be difficult to measure by the pound, especially when small quantities are issued, and sticks are returned at times to the magazine at the end of the shift. Forty boxes of powder were counted to arrive at an average stick cost per box. Whenever a new type or strength of powder is used, the same number of boxes is counted.

Different types of ground require different prices. As a consequence, three different ground classifications were used, namely, (1) hard ground, $0.05 per stick; (2) standard or regular, $0.065; and soft, $0.075. The mine foreman determines the proper classification for each working place. This is subject to change every two weeks if ground conditions change. At the start of each contract period the foreman posts a list of all working places and the powder classification for each place. When contracts are calculated, the miner can see on his contract summary how much he makes or loses on powder for the two-week work period.

AFTER

At first the miners were reluctant to accept the powder plan. The idea appeared revolutionary and they didn't understand the details. For a time some miners declined to change their old habits and lost money on their contract earnings. Those losing money studied the methods followed by those making a profit. This resulted in a demand for clay tamping as it was soon realized that a **stick of tamping is worth a stick or more of powder.** Practice of stemming is now religiously adhered to. Wooden spacers, 1x1x6-in., were introduced for use between sticks of powder for spacing the charge.

In some cases results were startling. One miner, blasting rock rated "standard" by the foreman, became so good with the use of spacers that he developed a considerable surplus of powder which for a time he retailed, under the counter, at an attractive price to less skilled miners. In some cases, so many wooden spacers were used that the fumes became objectionable and pieces of old diamond-drill core were substituted. As blasting practice improved, powder disappeared from muck piles and chutes, gas cases were minimized, and morale improved.

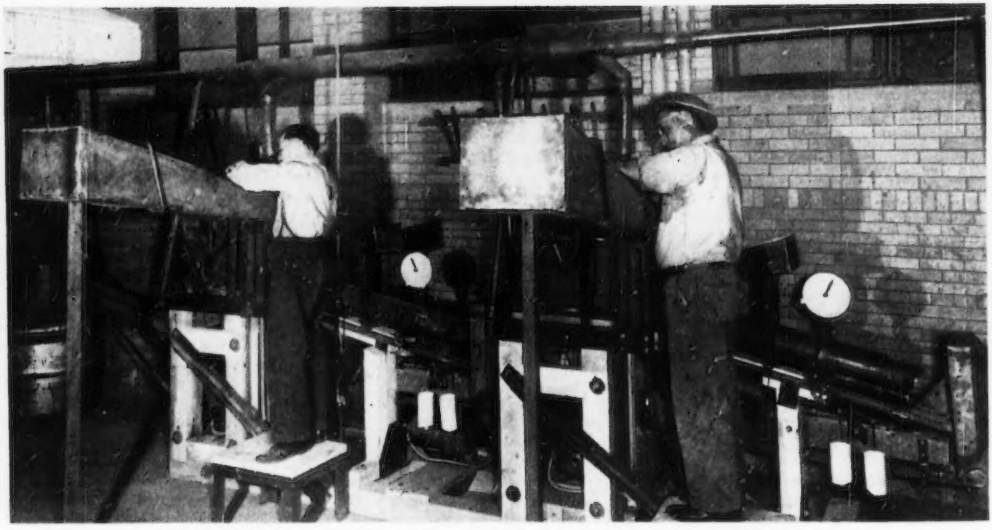
Instead of a standard five-finger burn cut round, the men experimented with different types of rounds in different types of rock. Each man undertook a little research on effective blasting practice and usually succeeded in cutting down the number of holes drilled. This meant lower air consumption and decreased machine wear and bit consumption.

Despite an early period of resistance by some miners, the company realized a net saving of $19,358.74 during the first year of operation of the powder plan, as indicated in the accompanying table (page 60).

The contract setup covering each two-week period shows the miners "earned money," which is money paid men for explosives by the increased contract breaking price. The "paid money" is the money the men paid to the company for sticks of powder used. The difference shows whether the miners are making or losing money on the project.

The plan has proved profitable to both the company and miners. Before its institution few men realized the cost of explosives. Now, miners are cost conscious. The miner must cut his previous consumption of explosives more than one-third to make money. Poorly drilled or timed rounds that mean re-blasting are a loss which is taken out of the miner's contract earnings. The result has been better drilled rounds with a minimum number of holes. Use of wooden spacers has clearly demonstrated that 1¾-in. starter and 1-9/16-in. finisher bits make too large a hole. Smaller drill holes with less volume would mean less powder and better distribution of the charge. Using wooden spacers to distribute the charge is simply filling too large a drill hole with wood. A smaller hole would accomplish better results with less cost.

A 30% saving in powder is not the ultimate, and the average miner is gradually improving his drilling and blasting practice for even greater economy. Our experience to date clearly indicates that operation of the powder plan is in no sense automatic. Constant vigilance is necessary on the part of the powderman, and the monthly powder inventory must be made with great care by responsible men. It has been demonstrated that both the company and miners can benefit by a study of the problem of drilling and blasting holes.



PRODUCTION-LINE PREPARATION of samples, involving crushing, pulverizing, mixing, and splitting, is brought to a fine art in USGS laboratory in Denver, where uranium samples are collected. Cost is $0.79 per sample.

Automatic Sample Preparation Saves Time, Money For USGS

You probably won't be asked to duplicate the U. S. Geological Survey's feat of handling about 2,000 samples of uranium "ore" each month. But we do think you'll be interested in looking over the ingenious devices the Survey has thought up to make their mammoth sample preparation job rapid, accurate, nearly automatic, low in cost.

WILLIAM P. HULEATT
Denver, Colo.[1]

UNDER THE EXPLORATION PROGRAM conducted by the Geological Survey for the Atomic Energy Commission, the Survey began several extensive field studies in the summer of 1946. These involved analysis of large numbers of samples ranging in size from 100-lb. sacks of 3-in. material to split drill cores weighing a few ounces.

These samples were taken throughout the country. No central laboratory was large enough to handle the load, and the analytical work had to be distributed among laboratories in several states. To insure comparable results, it was necessary that all samples be prepared for analysis in a uniform and accurate manner.

Few geologists are prepared to do this preparation job in the field, and even if they were, time spent on sample preparation would be at the expense of more profitable geological work.

Therefore, the Survey designed and built a clearing house at the Federal Center near Denver, where samples could be sent from the field projects in the Western States for uniform processing. From here the samples went to various laboratories for analysis.

The Denver laboratory was designed as an adjunct to a large-scale field sampling program with three services in mind—rapid, accurate, and uniform preparation of samples; storage of duplicate samples for future reference; maintenance of serviceable and uniform records. Automatic devices are used to reduce both error and labor.

On arrival at the laboratory, each sample is given a serial number that identifies it throughout the processing stages and on into the duplicate storage room. Each sample is also represented in the files by a 5x8-in. card on which are recorded all available data on the sample. For easy reference, these cards are cross-indexed with geologists' field designations, and a series of samples from one property is filed consecutively.

Processing Technique

All our samples arriving are classified as follows:

Class A samples are large and uncrushed, usually consisting of 10 to 100 lb. of 2-in. or 3-in. material.

Class B samples are smaller. They have been crushed in the field and reduced by splitting to about 10 lb. of ¼-in. material.

[1]Published by permission of the Director, U. S. Geological Survey, Department of the Interior, Washington, D. C.

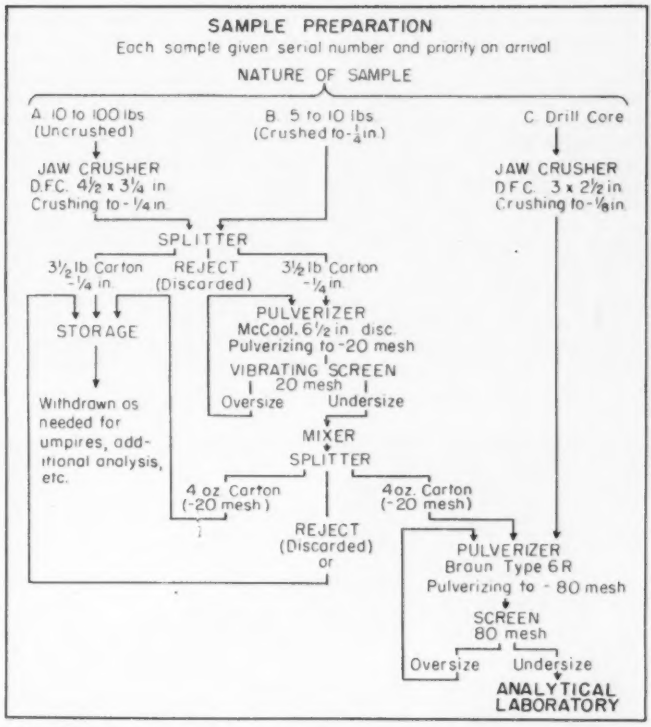
Class C samples are drill cores and hand specimens that need not be put through the large-scale automatic machines.

The treatment given each of these classes of samples is shown in the accompanying flowsheet. Basically, this involves the crushing, mixing, pulverizing, and splitting operations that go into any proper sample preparation job. In the Survey laboratory, however, there were several special conditions that called for special precautions and equipment.

Tests have indicated that splits as small as four ounces are not representative if taken directly from the material containing ¼-in. particles (this is because the gangue minerals in our samples are commonly harder and tougher than the ore minerals). Consequently the ore minerals are reduced to powder while the gangue is being crushed to a size that will pass out of the crusher.

The result is a mixture of coarse (up to ¼-in.) gangue and of powdered ore minerals. Because of the differences in size and specific gravities of the two types of minerals, they behave differently in the sampling machines, which results in misrepresentative splits.

More accurate results can be obtained by grinding the material to about 20 mesh and mixing it thoroughly before splitting into smaller portions. A preliminary grinding stage (McCool pulverizer) is therefore used in the processing of Class A and Class B samples, where grinding might otherwise appear to be superfluous.


SAMPLE PREPARATION
Each sample given serial number and priority on arrival
NATURE OF SAMPLE
A 10 to 100 lbs (Uncrushed)
B 5 to 10 lbs (Crushed to -¼ in.)
C Drill Core
JAW CRUSHER D.F.C. 4½ x 3¼ in. Crushing to -¼ in.
JAW CRUSHER D.F.C. 3 x 2½ in. Crushing to -⅛ in.
SPLITTER
3½ lb Carton -¼ in.
REJECT (Discarded)
3½ lb Carton -¼ in.
STORAGE
Withdrawn as needed for umpires, additional analysis, etc.
PULVERIZER McCool, 6½ in. disc. Pulverizing to -20 mesh
VIBRATING SCREEN 20 mesh
Oversize
Undersize
MIXER
SPLITTER
4 oz. Carton (-20 mesh)
4 oz. Carton (-20 mesh)
REJECT (Discarded) or
PULVERIZER Braun Type 6R Pulverizing to -80 mesh
SCREEN 80 mesh
Oversize
Undersize
ANALYTICAL LABORATORY

FLOWSHEET of Denver plant shows progress of samples through laboratory. Using ingenuity enables small crew to process 2,000 samples per month.

Dust Losses Important

Considerable dust is produced by the crushers and pulverizers. Ordinarily the loss of dust is unimportant as analysis has shown that in most samples the composition of the dust is similar to that of the sample as a whole. When processing certain ores, however, dust losses must be eliminated or at least reduced to a minimum inasmuch as the valuable mineral is soft and friable. Therefore, any dust escaping from the crusher or pulverizer will consist almost entirely of the valuable mineral. As the weight of the valuable mineral in our samples is normally very low in comparison to the weight of the gangue, even a slight dust loss will appreciably lower the grade of the sample.

The laboratory equipment includes two of each of the units shown in the flowsheet and described on the following pages.

Installation of dual equipment has the following advantages: (1) During periods of heavy demand, which normally occur at the close of the summer field season, two complete sets of equipment make possible the operation of two parallel but independent "production lines." (2) During periods of normal demand one set of equipment is usually sufficient to carry the load. At such times the second set acts as a "standby."

Each machine is equipped with one or more dust hoods connected to an exhaust system operated by two 12-in. Bayley Type SE centrifugal exhaust fans operating at 3,400 rpm. Tests have shown that this system reduces the atmospheric dust in the laboratory well below the danger point and the personnel operate without respirators. Radiometric measurements show the radioactive exposure to be substantially under the permissible 0.1 roentgen per day.

In both sets of equipment the individual machines are arranged in unit groups, each group being operated by one man.

The first unit group includes the large jaw crusher, mixing tube, sample splitter and duplicating mechanism. These units are built into one machine, and the flow of material through it is continuous and automatic.

The second unit group consists of the McCool pulverizer and attachments as shown in Figs. 5 and 6, and the mixer-sampler, Figs. 7 and 8. As the two machines are fully automatic and of practically equal capacities, either can be cleaned and loaded while the other is operating, making it possible for one man to operate both machines continuously.

The third unit group includes the two Braun pulverizers for use when Class A and B samples are processed or one small jaw crusher and one Braun pulverizer when Class C samples are processed.

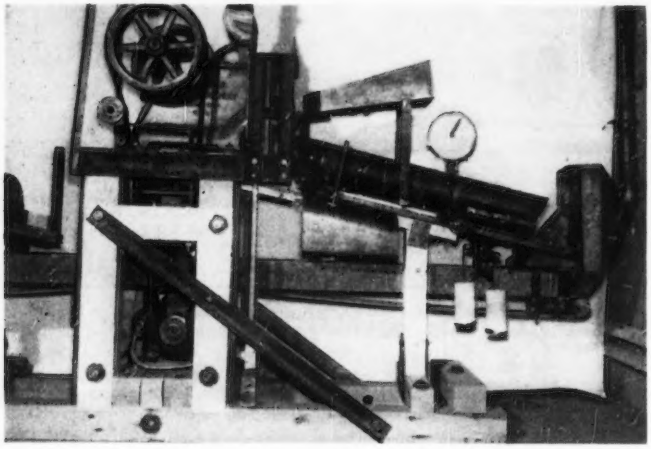
Three men, operating one set of equipment as described above, can process approximately 30 Class A or 50 Class B samples per day at average costs of 99 and 84c. per

sample, respectively, including labor maintenance of equipment, keeping of records, and storage of duplicates. It should be remembered, however, that Class B samples are crushed and partly reduced in the field before arriving at the laboratory at a cost of about 20c. per sample. This brings the total cost for Class B samples to $1.04, which is by no means excessive if the saving in transportation costs is taken into consideration.

As an illustration, during the fiscal year 1949 a project in the Northwest produced approximately 3,400 samples that weighed on an average 50 lb. each. These were crushed to ¼ in. and reduced to 10 lb. apiece in a portable field unit before shipping to the Denver laboratory. As the existing shipping rate of $5.34 per hundred pounds, the saving amounted to $6,582.40 for the 3,400 samples after deducting 20c. per sample for field treatment.

One man operating the third unit group only can process approximately 75 Class C samples per day at an average cost of 36c. per sample.

Since Jan. 10, 1949, the laboratory has been set up and is operating in temporary quarters pending the completion of alterations in another building that will provide space for a more efficient installation. From Jan. 10 to May 31, 1949, 8,077 samples had been received from field projects and other sources, prepared for analysis, and sent to the appropriate laboratories. This figure includes: 392 Class A, 4,743 Class B, and 2,942 Class C samples. On a monthly basis, 95 Class A, 1,077 Class B, and 599 Class C samples, or a total of 1,771 samples of all classes were processed a month at an average cost of 79c. a sample, which includes crushing and reduction of Class B samples in the field before delivery to the Denver laboratory.



PRIMARY CRUSHER reduces field samples to minus ¼-in., splits out portions.

Unit No. 1—Primary Crushing and Sampling

THIS UNIT takes 2 to 3-in. material, crushes it to ¼ in., mixes the quarter-inch material, and cuts out a 7-lb. fraction, which is divided into two 3½-lb. duplicates.

The crushed material passes through the chute (B) (Fig. 1) into a 42-in. length of 6-in. Shelby tubing (C), the lower end of which terminates in a spiral cut with a 7-in. pitch.

The mixing tube is mounted on four ball-bearing rollers (Q) with its axis inclined at an angle of 10° to the horizontal. Four 1-in. mixing baffles (D) extend along the inside wall 12 in. from the upper end. The tube rotates at a speed of 36 rpm.

The baffles in the upper end of the tube mix the material as it enters and also cause it to flow in a uniform stream toward the lower end. The point of discharge at the lower end of the tube follows the spiral which, owing to the rotation,

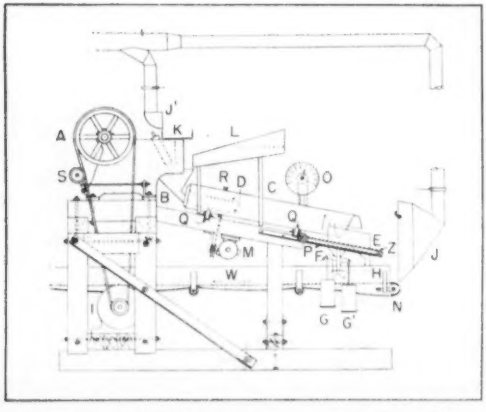


FIG. 1. MECHANISM of primary crusher shown above. See text for explanation. Sampler cuts out 3½-lb. splits.

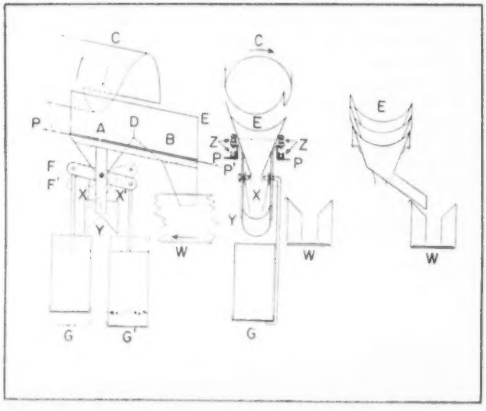


FIG. 2. DETAIL of sampler shows how two accurately weighed portions are taken regardless of size of sample.

has the effect of shortening the tube and causes the discharge to recede to the upper end of the spiral, where it is cut off by the straight part (Fig. 2). The material then flows down the tube until it is again intersected by the spiral and the receding discharge is resumed. The over-all effect is an intermittent discharge that, while flowing, moves at a constant rate along a straight line.

How Sample Is Cut

The discharge from the tube falls into the movable receiver (E) (Fig. 2), which is divided into two compartments. As the discharge retreats to the left once during each revolution of the tube it is divided into two fractions by the vertical wall (D) (Fig. 2). The right-hand fraction that constitutes the reject falls into compartment (B) and thence to the belt conveyor (W) for removal. The left-hand fraction that represents the sample falls into compartment (A), the bottom of which resembles a square funnel with a swinging nozzle (X) attached to a balance beam (F).

A one-quart waxed cardboard carton (G, G', Fig. 2) with a 3½-lb. capacity is hung from each end of the beam. When the beam is in position (F) and the nozzle in position (X), (represented by the solid lines), the sample delivered by one revolution of the tube flows down through the compartment (A) and the nozzle, and is directed into carton (G) by the divided chute (Y). The added weight of the sample in carton (G) causes the beam to swing to position (F) and the nozzle, which is now in position (X') (shown by dotted lines), directs the next batch of sample into carton (G'). The operation is repeated for each revolution of the tube, and the beam, being balanced on a knife edge, is sufficiently sensitive to produce duplicate samples of almost identical weights.

3½-lb. Splits Are Exact

Although there is little or no uniformity in the sizes of the original samples, it is desirable to obtain from each sample two 3½-lb. duplicate splits; no more, no less. In order to accomplish this, the receiver (E) and the attached beam balance, divided chute, and carton hangers are built into one unit free to slide back and forth on a track (P-P') Fig. 2. The unit is moved by means of a chain-and-sprocket system manipulated by a hand wheel (see P and Z, Fig. 1), which is also connected to the hand on the dial (O) which is graduated in pounds from 5 to 150. Turning the hand wheel in a clockwise direction moves the receiver unit to the right and at the same time rotates the dial hand through a proportionate angle.

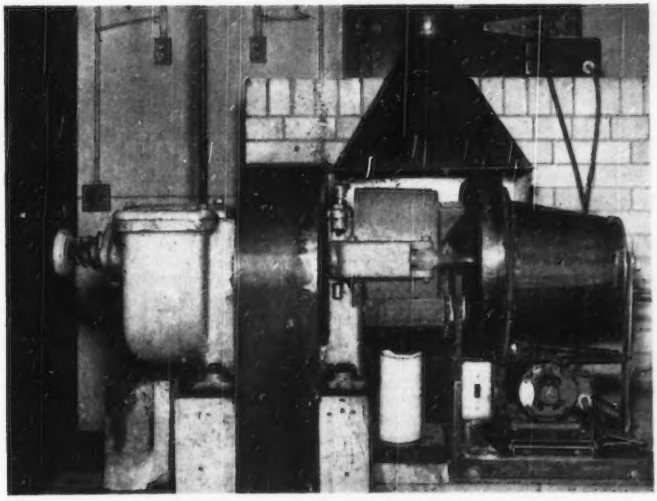
As the receiver is moved to the right, more and more of the material from the tube is caught by compartment (A) and eventually ends up in the sample cartons while a correspondingly smaller amount falls into the reject compartment (B).

Receiver Makes 7-lb. Cut

In practice, the original sample is weighed on a spring scale before being fed to the crusher. The hand on the dial is turned by means of the hand wheel to the corresponding weight on the dial, which automatically spots the receiver in the proper position to collect a 7-lb. cut that is distributed equally into the two containers. These are the two 3½-lb. cartons indicated in the flow sheet, one of which is stored for future use and the other pulverized to minus 20-mesh.

Class B samples that have previously been crushed and partly reduced in the field are not recrushed in the laboratory but fed directly into the hopper (B) from the loading chute (L), Fig. 1.

Unit No. 2—Pulverizing



AUTOMATIC PULVERIZER works in closed circuit with 20-mesh screen. Operator puts in sample, stands back. Drum at right mixes product and returns oversize to the pulverizer.

THE 3½-LB. SAMPLE of ¼-in. material from the crusher is ground to minus 20-mesh in a McCool pulverizer with 6½-in. disks.

The sample is ground at this stage to condition it for splitting into smaller fractions in the next operation, which cannot be done accurately with coarser material. This necessitates reduction of the entire 3½-lb. of material to minus 20-mesh, and as the pulverizer is by no means 100% efficient, the material must be screened continuously as it comes from the grinding disks and the oversize returned for regrinding until all passes through the 20-mesh screen. The performance of such an operation by hand on large numbers of samples is too time-consuming. Accordingly, a machine was designed and constructed to do the work automatically.

Actually, the machine consists of two parts: a shaking screen attached to the pulverizer head, and a combination mixing drum and elevator that returns the screen oversize to the pulverizer.

The screen (J), Fig. 3, is set in an enclosed hopper that is attached

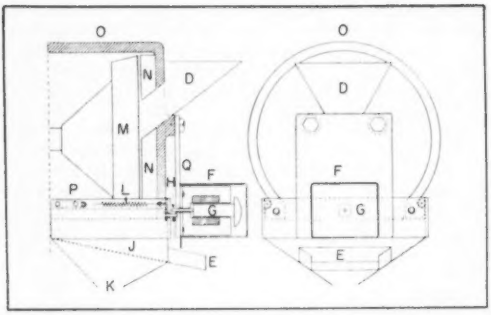


FIG. 3. PULVERIZER SCREEN is placed under grinding disks. Springs and rapper furnish vibration (see text).

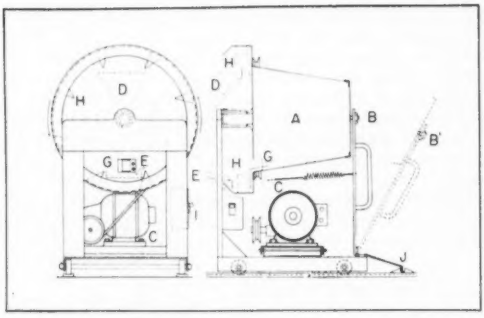


FIG. 4. AUTOMATIC RETURN of screen oversize to pulverizer is thru drum (A). Operator is free for other work.

to the pulverizer in such a position that it catches the discharge from the grinding disks (M and N). The hopper is mounted on slides (P and I), which permit it to be shaken back and forth through an amplitude of about ¼ in. by the combined actions of the springs (L) and the solenoid plunger (G), which is actuated intermittently by an interrupted 110-v. current. The interruptor, not shown in the diagram, consists of a commutator and brushes mounted on a small-geared motor operating at 250 rpm.

The operation is essentially as follows: the springs force the hopper and screen forward (to the right) until they come to rest against the vertical plate (Q), which acts as a forward stop. On receiving an impulse from the commutator, the hammer (H) attached to the solenoid plunger (G) strikes the hopper a sharp blow, forcing it back about ¼ in. When the solenoid circuit is broken by the commutator the springs drive the hopper and screen back to the forward position. This operation, repeated 250 times per minute, imparts a lively oscillating motion to the screen, which insures efficient screening and causes the oversize to work down the sloping surface of the screen and out through the chute (E) into the elevator shown in Fig. 4. The undersize from the screen drops out through the opening (K) and is caught in a container.

The elevator, Fig. 4, consists of a rotating circular trough equipped with eight elevating buckets (H) and is attached to a mixing drum (A). The rear end (B) of the mixing drum is mounted with ball bearings on a hinged support and, being free to rotate, acts as a rear support and bearing for the mixing drum when closed.

In operation the cover (B) is opened and the 3½ lb. of ¼-in. material from the crusher is put into the mixing drum and the cover replaced. During each revolution of the drum a small amount of material flows out through the opening (G) into the trough, where it is picked up, together with the oversize from the screen, by the buckets (H) and delivered to the pulverizer through the chute (D). Sufficient new material enters the circuit from the mixing drum during each revolution to compensate for the withdrawal of the finished product and to maintain a constant load on the pulverizer until the operation is complete.

The drum is rotated at a speed of 9 rpm. by a 1/20-hp. 115-v. Boston Gear Works gearhead motor with a pulley speed of 43 rpm. It requires approximately 53 revolutions or six minutes to empty the mixing drum and about three minutes more to clear the circuit, clean the machine, and charge it with a new sample.

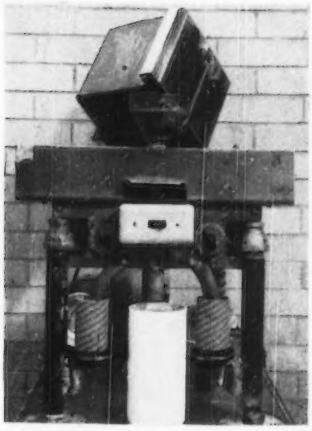
Unit No. 3–Mixing and Sampling

THE 3½-LB. SAMPLE of 20-mesh material from the pulverizer is further mixed and reduced to one or two smaller splits as required for analysis. The mixing is done in a revolving 6-in. cubic tumbler. (See A, Figs. 5 and 7.) The machine is designed so that either one or two splits can be obtained, each representing one, two, three, or four twenty-fourths of the sample.

The tumbler is rotated at 30 rpm. by a 1/20-hp. Boston Gear Works gearhead motor with a pulley speed of 43 rpm. At a certain point during each revolution approximately ½ oz. of material escapes from the tumbler through the opening (B), Fig. 5, and runs down through the tube (C) into the stationary funnel (D). Immediately below is a movable funnel (E) attached to the plunger (F) which is common to the two solenoids (M and N). When neither of the solenoids is in action, the funnel (E) is kept in the center position by the centering springs (Q) and any material coming from the tumbler passes into the reject container (K) via the tube (H). When either solenoid is actuated, the funnel (E) is moved to the right or left and the material is directed through the tube (I) into the container (L) or through tube (G) into container (J). When the circuit is broken, the funnel (E) returns to the central position and all surplus material not deposited in containers (J and L) is returned to the original container (K) to be stored or discarded as desired.

The mechanism that operates the solenoids consists of a 24-point distributor (V), Fig. 7, in series with two hand-operated switches (O and P), Fig. 5. The electrical connections are shown in the wiring diagram, Fig. 6. The mechanical features are shown in Fig. 7 and the operation is essentially as follows: (V) is a stationary disk of non-conducting material on the face of which 24 contact points are equally spaced on a 5-in. circle. Inside this circle is a 2½-in. brass ring (Fig. 6). Opposite disk (V), Fig. 7, is a metal disk (U), which has 24 notches equally spaced around its periphery and which is free to rotate on the horizontal tumbler shaft.

On the face of disk (U) are mounted two brushes connected electrically with each other. The brush



MIXING AND SPLITTING final sample is precise automatic job using this USGS-built device.

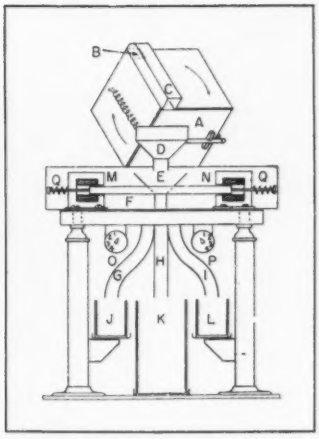


FIG. 5. DETAILS of mixing and splitting equipment show simplicity of the method.

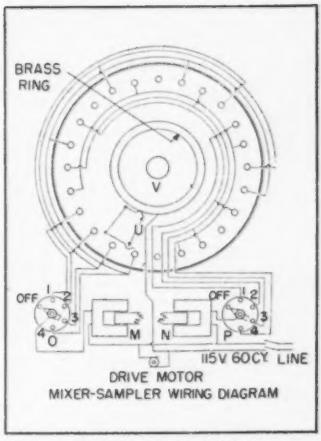


FIG. 6. WIRING DIAGRAM for control governing proportioning of samples (see text).

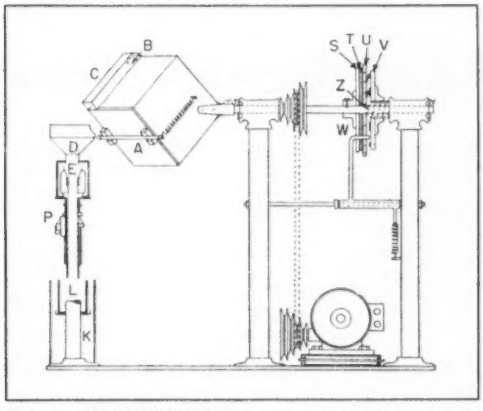


FIG. 7. MIXER-SAMPLER set-up shows how sample mixed in compartment A is split through tube E.

nearest the shaft is in continuous contact with the brass ring on disk (V) and the outer brush makes contact with one of the 24 contact points every 1/24th revolution of disk (U).

Disk (S) rotates with the shaft and is faced with clutch lining (T) against which disk (U) is tightly pressed by the compression spring (Z). Disk (U), therefore, tends to rotate with disk (S) but is prevented from doing so by the pawl (W), which engages in one of the notches in its rim. Disk (S) has on its rim a single cam (not shown in the diagram) which once in each revolution raises the pawl momentarily out of its notch and allows the disk (U) to move 1/24th revolution before it is again stopped by the pawl falling into the next notch.

This brings the outer brush into contact with the next contact point on disk (V), which may or may not actuate one of the solenoids, depending on the position of the manual switches that must be closed to complete the circuit (Fig. 6). In general the assembly operates like a circular 24-point distributor whose arm is ratchetted from one point to the next each revolution of the shaft.

As an example, consider the right-hand control switch (P) to be set at 1 and the left-hand switch (D) at 3. A ½-oz. fraction of the material in the tumbler will be deposited in container (L) and three ½-oz. fractions in container (J) during each 24 revolutions of the tumbler. Theoretically, when the tumbler has been emptied, container (L) will have received 1/24th and container (J) 3/24th or 1/8th of the original sample.

If the number of revolutions necessary to empty the tumbler were evenly divisible by 24, the proportioning would always be exact, and the size of the opening was designed to fulfill this requirement as nearly as possible. As the error in any one operation can never be more than ½ oz. of material in a 4-oz. split, the chemist is always certain to receive sufficient material for testing.

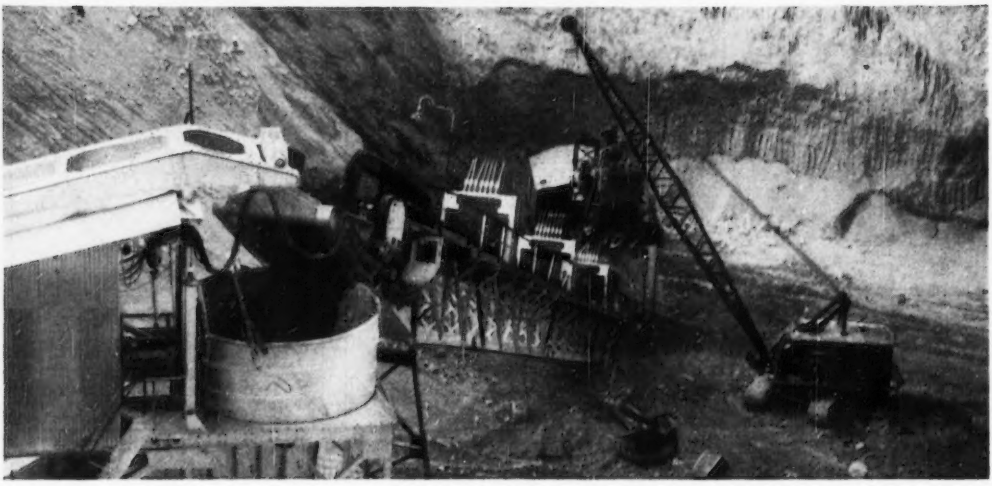
The machine is operated in conjunction with the McCool pulverizer unit by one man who can usually process 50 samples a day through both machines.

Final pulverizing and screening.—The reduced sample of 20-mesh material obtained from the previous operation is finally ground to the proper mesh for analyzing. Most chemical and radiometric laboratories prefer to have their samples ground to minus 80-mesh, and minus 200-mesh is required for spectrographic analysis.

The material is reduced from minus 20- to minus 80-mesh in a Braun, Type 6R, pulverizer, with enclosed 6-in. grinding disks.

The pulverizer is loaded, the product screened, and the screen oversize returned by hand for regrinding. The screening is greatly expedited by the use of "vibrating boxes," which are shallow boxes with the tops mounted on rubber cushions. When an ordinary standard sieve type screen is pressed down on the top of the box, the pressure causes a micro-switch to close the circuit to an electric vibrator mounted on the under side.

Small samples intended for spectrographic analysis are first ground to minus 80-mesh in the Braun pulverizers and further reduced to minus 200-mesh in a Fisher mortar grinder.



1. ELECTRIC SHOVEL and diesel-powered dragline supply steady flow of ore which passes through grizzly to 60-in. pendulum conveyor. Hopper at top feeds a portable crusher which discharges to 42-in. belt conveyor system.

New 17,000-ton Dry-Land "Dredge" Uses

JOHN B. HUTTL
Associate Editor

MINING GOLD-BEARING GRAVEL at a daily tonnage rate closely approaching that of some porphyry copper mines in the west is a task rarely performed in the gold mining industry. An exception is the Round Mountain Gold Dredging Corp., Nye County, Nev., which since Jan. 1, 1950, has been operating a plant capable of handling 17,000 tons of gravel a day. The word "dredging" in the name of the company may be a little misleading, for while exploitation of the available gravel deposit follows conventional dredging methods somewhat, the operations are not strictly of the bucketline dredge type. True, the installation at Round Mountain does resemble a large dredge, but on dry land, with the central washing plant representing the dredge body proper; the electric shovel in the pit and conveyor system leading to the plant, the digging ladder; and the two adjustable waste conveyors, the stacker. Gravel fed by conveyor to the washing plant receives similar treatment as that elevated by the bucketline to the gold recovery equipment installed atop the hull of a bucketline dredge.

4. THIS 36-IN. BELT leading to a boom stacker transfers sands from the washing plant to waste pile, and corresponds to the stacker on floating dredges.

The town of Round Mountain lies at an elevation of about 6,300 ft., 55 miles north of Tonopah, the nearest supply center. It derives its name from a mountain rising several hundred feet above the surrounding country containing the principal lode deposits, the more productive ones being known as the Los Gazabo, Keane and Placer. From the erosion of these veins and the stringer zone lying between them, the main placer deposits now under exploitation have been derived. The principal lode deposits were discovered by Louis D. Gordon in 1906, and in the same year Thomas Wilson found placer gravel. Both lode and placer mining have

2. CRUSHED GRAVEL on 42-in. belt system is delivered to stockpile via 700-ft. conveyors suspended from tower.

3. STOCKPILED ORE goes to washing plant housing jigs, tables, amalgamators, and grinding and classifying units.

Draglines, Shovel, Belts, Washing Plant

been carried on intermittently since then. The first mechanical placer equipment was installed in 1934 by Nevada Porphyry Gold Mines, Inc., and capacity of the initial plant was 1,000 yd. of gravel per day.

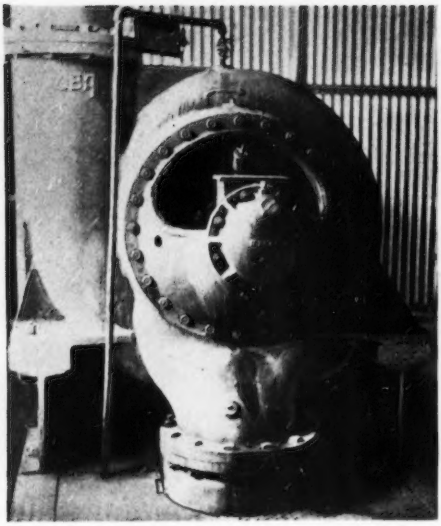
The main placer deposit is on the south and west slopes of Round Mountain. It is of the residual type, none of the gold having traveled more than several hundred feet from its source. Gravel depths vary from a few feet to more than 200 ft. About 20% of the gravel consists of coarse angular boulders of rhyolite, the remaining 80% being sand and gravel, and the bed is slightly stratified. The gravel is bonded by a limy deposit into a medium hard conglomerate, particularly near bedrock. The gold is disseminated throughout the gravel, with enrichments near bedrock, and the gold particles are angular and show no evidence of having been transported. Many are encrusted with quartz or siliceous limonite. The gold recovered from previous placer operations averaged 635 fine, being alloyed with silver. Bedrock is a rhyolite porphyry, uneven in many places.

The large-scale placer operations now in progress were started by Round Mountain Gold Dredging Corp. early this year, and the construction program preceding them involved building a large central gravel washing plant, preparation of pit, installation of a portable crushing plant, and conveyor system for transporting mined and crushed gravel from the pit to the washing plant and a water supply system. Pit methods and equipment used very much resemble those employed in the modern mechanized gravel plants active in the Los Angeles area, with the shovel working against a face or bank exceeding 100 ft.

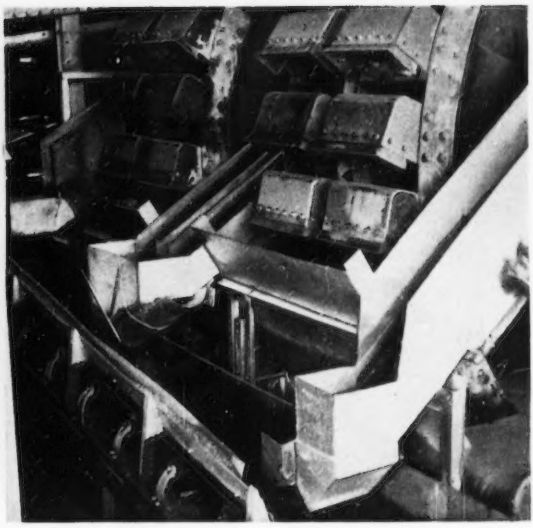
This high bank presented quite a problem, for while the gravel will stand practically vertical for a height of 100 ft. or more, there is danger of caving as the shovel undermines the bank. The difficulty was overcome by the use of a heavy plow or scarifier operated by a dragline stationed on the original ground surface on top of the bank. The scarifier is pulled up the face or bank with the drag cable on the dragline and is dropped down the bank, suspended on the hoist cable running over the boom sheave. In this manner, the slope of the bank is reduced to about 70 deg. with the horizontal, and the scraped material accumulating at the floor of the pit is bailed by the shovel into a loading hopper. The shovel digs only the lower portion of the bank.

Excavating equipment in the pit consists of 7½-yd. Bucyrus-Erie 170-B electric shovel. A 54-B diesel dragline operates the plow or scarifier mentioned previously. The electric shovel loads directly into a circular steel hopper containing a Jeffrey feeder at the end of a 60-in. pendulum conveyor which subsequently elevates the grizzly undersize material to a portable crushing plant housing a 36x42-in. jaw crusher. The heavy steel grizzly on top of the loading hopper is spaced 24 to 30 in. A second diesel dragline is stationed near the loading hopper in the pit to service the heavy grizzly and remove large boulders therefrom. Crushed gravel is elevated by a 42-in. belt conveyor to the transfer point at the end of the main 42-in. conveyor leading to the stockpile at the head of the washing plant.

As the shovel advances, extra sections are added to this conveyor. The main 42-in. conveyor is installed in two sections—an 1,800-ft. unit receiving material at the edge of the pit and having a transfer point at the discharge end, and a 700-ft. unit leading from the transfer point to the stockpile resting on a long concrete tunnel. The discharge end of the shorter conveyor is suspended from a vertical steel tower and can be adjusted to meet the height of the stockpile. Material from the stockpile is drawn through two feeder gates in the tunnel equipped with hinged rail



INSIDE THE WASHING PLANT, water is supplied by two 14-in. pumps, one high-pressure and one low-pressure.



Jig overflow and classifier overflow are handled by the 14-ft. twin sand wheel shown at right. Sands go to waste.

sections and elevated to a 9x50-ft. revolving screen on the top floor of the washing plant.

The building housing the gravel treating equipment is an all-steel structure covered with corrugated galvanized iron sheets. All equipment units are easily accessible for adjustment and repair, and as on a bucketline dredge the flow of material from the stockpile to the washing plant can be observed and controlled from a central point or room facing the stockpile tunnel. Here a Ratograph is installed which indicates to the operator the rate at which the material flows to the revolving screen. A Merrick weightometer is installed in the stockpile tunnel.

Flowsheet of the washing plant is as follows:

The plant is divided into a coarse jigging section and a fine jigging section. Washing and scrubbing is done in the revolving screen covered with screen sections containing ½-in. holes. Undersize is passed over four 4x12-ft. Tyrock vibrating screens, while the oversize goes via twin 36-in. boom conveyors or stackers to the waste pile. The conveyors are built in sections and are lengthened whenever desired. The oversize from the Tyrock screens goes to four 42x42-in. 4-cell Yuba jig units, with the overflow passing to a twin 14-ft. coarse sand wheel, and a hutch product flowing successively over riffled gold tables, and a 42x42-in. 2-cell Yuba cleaner jig. Sands from the sand wheel join the revolving screen oversize and go to the waste pile, while the overflow goes to a small settling tank to trap any coarse material and thence to the 250-ft. traction thickener.

Jigs Recover Gold

Undersize from the Tyrock screens flow to a 36-ft. Dorr hydro separator. The overflow from this unit goes to a 250-ft. Dorr traction thickener outside the washing plant building, and the underflow is passed over six 42x42-in. 4-cell Yuba jig units. Overflow from these jigs after passing over riffled gold tables goes to a 24-ft. Dorr hydro separator, while the hutch product receives added treatment first on riffled gold tables and then in a 42x42-in. 4-cell Yuba jig unit. The hydro separator underflow is directed to the fine sand wheel, and the overflow to the 250-ft. traction thickener.

The hutch product of the 4-cell cleaner jig goes to a Dorr classifier operating in closed circuit with a ball mill equipped with an amalgamator on the discharge end. This classifier also receives the hutch product of the 2-cell cleaner jig in the coarse jigging section. Overflow from this jig goes to the fine sand wheel, which also receives the classifier overflow after passing over riffled gold tables. The overflow from the fine sand wheel returns to the 250-ft. traction thickener, and the sands go via a conveyor belt to the two boom stackers and to waste. Plant water is supplied by two 14-in. Yuba pumps, one high pressure and the other low pressure, taking suction in the sump receiving the overflow from the 250-ft. traction thickener.

The primary water supply is obtained from three sources—namely, (1) water rights on Jett Creek. The water is brought to the plant via an 8-mile 14-in. pipe line and pumping plant. (2) "A" well equipped with deep-well and booster pumps; and "B" well equipped with deep-well and booster pumps. Both pump installations are connected to the Jett Creek pipeline. Distance from the washing plant is 4 and 3 miles, respectively. The pumps are manually controlled from the washing plant control station. Automatic operation is planned. Power is obtained from the Sierra Pacific Power Co.'s 66,000-v. power line running from Tonopah to Round Mountain. Additional surface plant buildings include a combination office and warehouse building, retort plant, and general repair shop.

In conclusion I wish to thank W. C. Browning, vice president and consulting engineer, for permission to publish the foregoing article, and grateful acknowledgment is made to E. H. Oshier, field superintendent for the courtesies shown me while visiting the plant.

Cyclone Separator May Be Solution For Fine Iron Ore Problem

SATISFACTORY CONCENTRATES were obtained in an M. A. Hanna pilot plant run during 1949 on minus ¼-in. iron ores. Heart of flowsheet, as shown here, was DSM cyclone.

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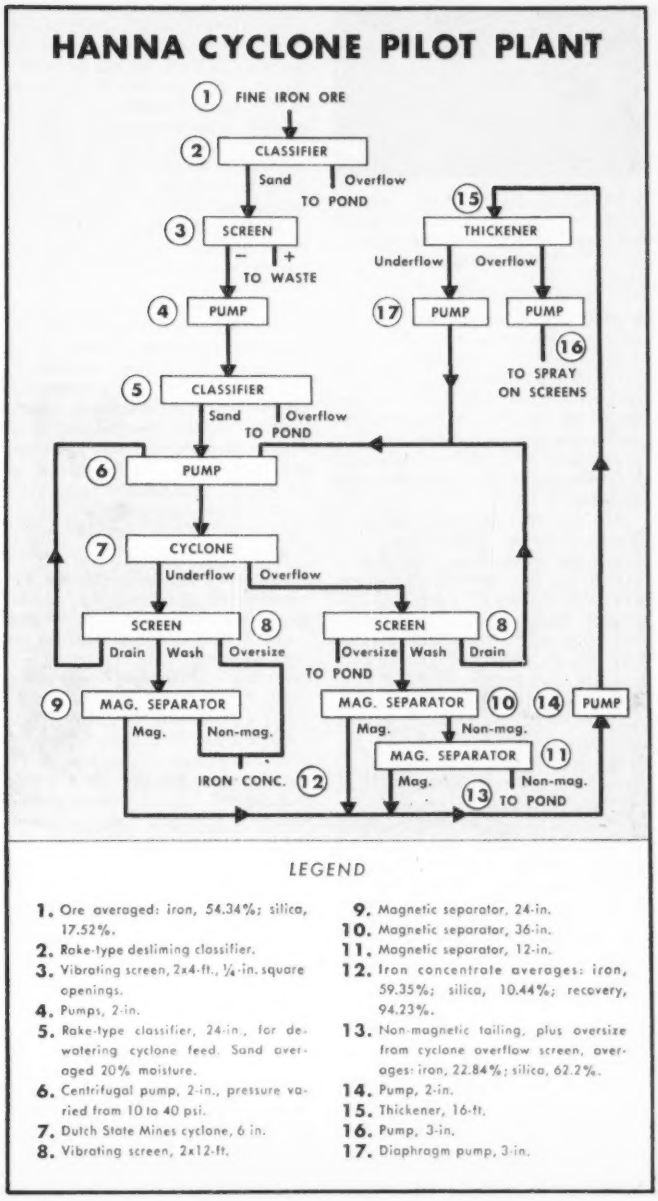

LEGEND

1. Ore averaged: iron, 54.34%; silica, 17.52%.
2. Rake-type desliming classifier.
3. Vibrating screen, 2x4-ft., ¼-in. square openings.
4. Pumps, 2-in.
5. Rake-type classifier, 24-in., for dewatering cyclone feed. Sand averaged 20% moisture.
6. Centrifugal pump, 2-in., pressure varied from 10 to 40 psi.
7. Dutch State Mines cyclone, 6 in.
8. Vibrating screen, 2x12-ft.
9. Magnetic separator, 24-in.
10. Magnetic separator, 36-in.
11. Magnetic separator, 12-in.
12. Iron concentrate averages: iron, 59.35%; silica, 10.44%; recovery, 94.23%.
13. Non-magnetic tailing, plus oversize from cyclone overflow screen, averages: iron, 22.84%; silica, 62.2%.
14. Pump, 2-in.
15. Thickener, 16-ft.
16. Pump, 3-in.
17. Diaphragm pump, 3-in.

SUITABLE PROCESSES for concentrating iron ores in coarse sizes are well known and widely used on the Mesabi iron range. What is needed is a workable process for handling iron ores through the size fractions from 3/16-in. on down through 65 mesh.

The test and pilot plant work described here indicate that the Dutch State Mines cyclone separator will serve as the basis for such a process. On a minus ¼-in. feed, assaying 54.54% iron and 17.52% silica, it produced a concentrate running 59.35% iron and 10.44% silica. Recovery was 94.23% of the iron, 51.43% of the silica. Test conditions and other results will be described.

Cyclone for Iron

The first publicized use of cyclones for separating minerals suspended in water was made by M. G. Driessen in 1937 at one of the Dutch State coal plants in the Netherlands. He used the cyclone to densify the loess medium used in the mine's sink and float plant. He noticed that the cyclone concentrated fine coal along with thickening the medium. This led to the cyclone separation processes, which are distinct and apart from the classifying or thickening functions of the cyclone.

In effect, the cyclone as a separator adds a new concept to mineral dressing. For example, the standard Heavy-Media Separation process can be considered a static system. The mineral particles either sink or float, depending on their static specific gravity.

The cyclone separator, however, must be considered a dynamic system. In the cyclone, the multiplication of gravity greatly increases specific gravity differences in mineral particles and lifts the process out of the range of simple sink-or-float activity. It was thought that this dynamic factor might make

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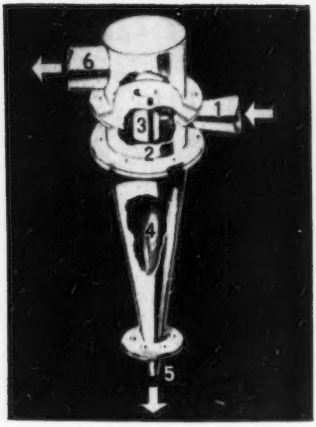
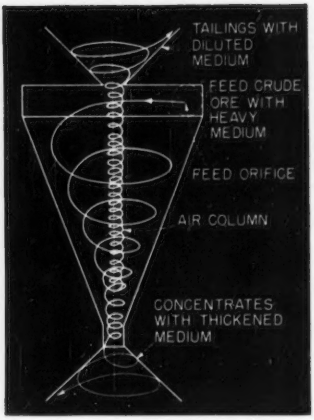


SIMPLE ELEMENTS make up cyclone: 6-in. inside diameter, 20-deg. included angle in cone, and 25.75 in. high.



PARTICLE PATHWAYS are as shown. Centrifugal, centripetal forces increase mineral specific gravity differences.

the cyclone work well on the finer sizes of iron ore.

Preliminary tests on iron ore samples were made by the American Cyanamid Co. at its Stamford Laboratories. These tests were highly encouraging and, therefore, arrangements were made with the University of Minnesota Experiment Station to conduct further tests on the process. A large number of semi-continuous and batch scale tests were run in the fall of 1948. On the basis of information and data gained in these tests a continuous pilot plant was erected and operated at one of the Hanna Ore Mining Company's properties during the 1949 season.

How It Works

The general shape and dimensions of the pilot plant cyclone are shown in the accompanying sketch. The ore fed to this 6-in. cyclone normally must all be minus ¼ in., although indications are that a larger cyclone could treat coarser feed. The ore to be treated is suspended in a medium made up of finely ground magnetite. This pulp is fed under pressure tangentially through the feed orifice, (1) in the sketch to the short cylindrical section (2). The short cylindrical section (2) also carries the central "vortex finder" or top orifice (3) which prevents short-circuiting within the cyclone. Separation is made in the cone-shaped part of the cyclone (4) by the action of the centrifugal and centripetal forces. The heavier portion of the material treated leaves the cyclone at the apex opening or bottom orifice (5) and the lighter portion leaves at the overflow top orifice (6). It is important to note that there are no baffles inside the cyclone and that no moving parts are involved. The principle of the cyclone separator is outlined in the accompanying diagram.

The pressure at which the pulp is introduced into the cyclone is one means of controlling the forces within the cyclone and, therefore, will vary depending upon the separation that is desired. Operating pressures vary from about 10 to 40 psi. These pressures are readily reached and maintained with a standard centrifugal pump.

Changes in the diameter of the openings of the feed inlet (1), the apex opening (5), and the top orifice (3), or the included angle of the conical section (4), and the relation of the size of each opening to the others have a marked effect on the results obtained and the capacity of the cyclone. For instance, any reduction in the diameter of the apex opening (5) will tend to increase the specific gravity at which the separation takes place. Some of the factors which determine the size of the openings are: (a) the size range of the material to be treated; (b) the size of the largest feed particle; (c) the percentage of near-gravity material in the feed; and (d) the desired time of retention of the pulp in the cyclone.

The other factors that control the separation obtained are the specific gravity of the medium and the particle size of the medium itself. It is of interest to note that in contrast with the usual sink-and-float separation, the static gravity of the medium fed to the cyclone is not the same as the gravity at which separation actually takes place. In general, with a magnetite medium, the centrifugal and centripetal forces present in the cyclone in effect add from 0.5 to 0.7 to the static specific gravity.

In treating most materials, an exogenous medium—that is, one made up of material not present in the ore to be treated—is preferred. In the case of some iron ores, operation with autogenous medium, or one made up from the ore constituents, appears possible. The most practical media are the magnetic type. For the tests described in this paper a finely ground magnetite medium which had been produced from magnetic taconite was used.

The detailed formulas and calculations that fully explain the cyclone principles have been presented in several papers by M. G. Driessen, notably one published in the December, 1945, issue of the *Journal of the Institute of Fuel.* These theoretical considerations will not be repeated here.

The Pilot Plant

A flow scheme of the original continuous pilot plant is shown. The selection of equipment and its arrangement was to some extent governed by the availability of an unused building. This required use of several pieces of superfluous equipment, namely, a feed pump, a dewatering classifier for the feed, and a medium handling pump. The pilot plant ran with this flow scheme for several months. The main bottleneck proved to be the pump and dewatering classifier used to deliver the ore to the cyclone pump.

Basically the pilot plant consisted of an ore flow scheme and a medium flow scheme. In this respect it was substantially the same as the usual static Heavy-Media plant, the distinctive feature being separate medium cleaning circuits for both the concentrate and tailings products.

Later the washing on the screens was eliminated and the screens were used only for medium drainage. With this flow scheme all of the products were washed, and the medium was removed from the ore in the magnetic separators.

This later flow scheme appears to

be preferable for treating ore in the size range tested when practical operation is considered.

The Medium

The medium used for these tests was finely ground magnetic concentrate produced from the so-called magnetic taconites. The specific gravity of the dry solids was 4.49. The average size of the material was as follows:

Mesh	*% Weight*
+ 65	1.5
+100	1.3
+150	3.2
+200	6.2
+270	8.6
+325	5.4
—325	73.8
Total	100.0

About 16% was finer than 7 microns in size.

In general the static specific gravity of the medium fed to the cyclone ranged between 2.3 and 2.5. The maximum separating gravity obtained in the pilot plant with a magnetite medium was about 3.00. For higher separating gravities it would appear that a mixed medium would be required, for example, one made up of magnetite with a small amount of ferrosilicon.

The total medium fed to the cyclone consists of two parts:

1. Medium drained from the ore particles through the drainage screens and sent directly back to cyclone feed sump.

2. Cleaned medium which was recovered from the ore particles by means of the magnetic separators and then densified in the rake-type thickener.

The Ore

The ore fed to the cyclone was screened through a 3/16-in. square opening screen and was then washed in a primary rake classifier which eliminated most of the slime fractions. The structure of the ore feed to the cyclone was about 13% plus 6 mesh and about 3% minus 100 mesh. The ore as delivered to the cyclone feed sump through the dewatering classifier averaged about 20% moisture.

The average pilot plant feed rate for 158 hours of operation was about 6.0 dry long tons per hour, but for periods of several hours the feed rate to the 6-in. cyclone was held at 9 dry long tons per hour. However, due to the feed pump-classified bottleneck, this rate could not be maintained over a shift.

Small scale batch tests indicated that equally as good metallurgical results were obtained with ore-to-medium ratios of 1 to 1.8 as were obtained with ore-to-medium ratios of 1 to 9. These ratios are based on the weight of dry ore and on the weight of the medium pulp (dry magnetite plus water).

In the pilot plant operation, due to the dewatering classifier bottleneck, the ratio of ore-to-medium was limited to about 1 to 5. It is obvious that medium losses and gross power consumption would both be lower if the ratio of ore-to-medium could be held at a maximum.

The figures for ore-to-medium ratios given are for total medium used. The total medium usually was made up of about 50% drained medium and 50% cleaned medium.

The average results obtained in the pilot plant operation for the 1949 season are summarized in Table I.

TABLE I.—Average Results for 1949 Season of Pilot Plant Tests With Cyclone Separator on Fine Iron Ore

Product	% Weight	% Iron	% Silica	% Distribution Iron	% Distribution Silica
Feed	100.00	54.34	17.52	100.00	100.00
Concentrates	86.28	59.35	10.44	94.23	51.43
Tailings	13.72	22.84	62.02	5.77	48.57

TABLE II—Comparison of Laboratory Heavy Liquid Separations With Cyclone Pilot Plant Results Shows Cyclone 95-100% Efficient

Test No.	Product	Heavy Liquid Separations % Weight	% Iron	% Silica	Cyclone Concentrates % Weight	% Iron	% Silica
25	Sink 2.96	87.55	61.21	9.05	89.43	60.36	9.65
27	Sink 2.96	95.26	62.86	7.38	92.57	62.23	7.46
16	Sink 2.96	76.42	56.72	11.58	70.93	56.73	12.81
20	Sink 2.96	85.66	60.39	9.59	81.67	60.16	9.78
37	Sink 2.96	87.37	61.41	8.93	89.28	59.60	9.88

TABLE III—Typical Screen Analysis of Cyclone Products Shows Concentration in Plus 100 Mesh Sizes Only

Mesh	Combined Concentrates % Weight	% Iron	% Silica	Combined Tailings % Weight	% Iron	% Silica
+ 20	62.81	59.60	10.14	40.89	9.52	82.42
+ 28	11.63	58.55	11.40	9.78	12.66	76.95
+ 35	10.76	59.36	9.98	10.00	15.73	71.06
+ 48	7.36	62.50	6.94	7.44	22.10	61.55
+ 65	4.43	64.20	5.90	6.56	33.95	45.55
+ 100	1.42	65.00	5.90	5.56	42.91	34.52
— 100	1.59	40.49	38.85	19.77	33.95	46.08

Cyclone feed assayed 54.95% iron and 17.06% silica.

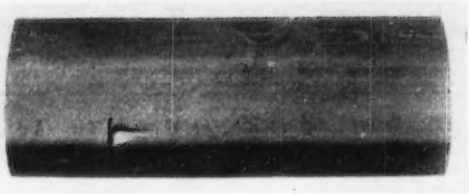
The goal in these operations was a concentrate containing 11% silica.

In order to show the comparative efficiency of the cyclone separation, static heavy liquid separations were made in the laboratory on the cyclone feed samples. Typical results obtained in these heavy liquid tests are given in Table II. These figures show that the efficiency of the separation obtained in the cyclone, as compared to laboratory heavy liquid separations, was between 95% and 100%.

Not for Minus 100-Mesh

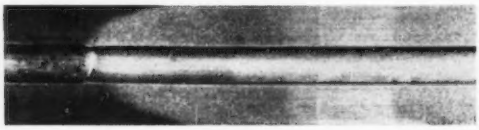
A typical screen analysis of the cyclone products is shown in Table III, so that the range of sizes treated can be visualized. It will be noted that the concentration obtained on every screen size down through the plus 100 mesh size resulted in a high-grade product. The tailing product was good down through the plus 65 mesh fractions. No practical concentration was obtained in the minus 100 mesh sizes.

1. SYSTEMATIC INSPECTION AND REPAIR of rods and machines could have prevented the worn lugs and rounded striking end of this drill shank. Worn parts inevitably aggravate errors made in drilling.



2. PROPER HANDLING might have prevented failure of this ⅞-in. hollow-hexagon drill rod. Dents, caused by striking rod with tools or throwing it about, keep the stresses from being evenly distributed, leading to fracture.

A



B

3. CORRECT HEAT TREATMENT of a 1¼-in. hollow-round drill shank end is exhibited by section A (at the left). Section B (above) shows that shank end was properly heat-treated, save that treatment did not overlap previously heated region, shown by light band near right end. Section C (left) shows that 1¼-in. hollow-round drill bar was improperly heat-treated. Light band across left end is much softer than dark part, which is oil-hardened. All three specimens of drill rod were cut lengthwise and etched with hydrochloric acid and water.

C

Proper Care for Hollow Steel Will Cut Your Drilling Costs

W. H. McCORMICK
Chief Metallurgist
and C. W. DARBY
Drill Steel Metallurgist
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Pittsburgh, Pa.

IF CONVENTIONAL hollow steel drills were kept in plush-lined cases, perhaps they would be treated as the expensive, fine tools which they are. As it is, they are frequently treated to every abuse in the book during forging, heat-treating and use, and are then the source of indignant wonder when they break.

The introduction of the jackhammer in 1912, and other powerful drilling tools, made the steel of earlier analysis obsolete and required the development of stronger steels to withstand the severe impact and fatigue of high-frequency blows. In a modern hammer these blows are delivered at between 1,800 and 2,000 per minute and each blow is struck with up to approximately 185 ft.-lb. of energy. Other developments, such as the machine sharpener and the detachable bit, also required corollary modifications in the metallurgy or forming and use of the drill steel.

Modern drill steel is capable of being hardened to produce tough, yet abrasion-resisting, cutting edges on a bit which is forged integral with the rod. It also possesses tough, fatigue-resisting shanks and bit connections.

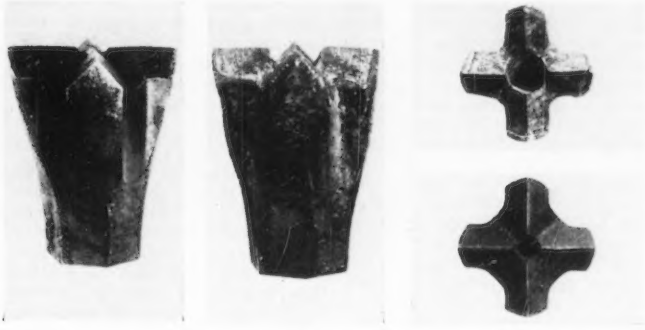
This up-to-date steel has also been made to take a large amount of abuse due to variations in the way it is forged, sharpened and hardened. However, although it is a high-grade tool steel, there are limits to its endurance under maltreatment.

The steel maker recognizes that a certain amount of abuse is inevitable, but we have found the following examples to be the most harmful and yet the most avoidable:

1. **Improper drilling.** This applies to all types—drifting, downhole and stoper—and refers to bad alignment of drill rod with machine, loose or sloppy machine set-up and improper feed pressure on drill rod. A hollow drill rod is intended and designed for percussion drilling. Naturally, best drilling efficiency and rod life cannot be achieved if the force of the hammer blow is not transmitted to the bit in a straight line. When the drill steel is forced out of alignment, stresses in the rod are increased enormously and failures proportionately. Bad alignment, unnecessary vibration because of a poor setup, and an improper rate of feed will result in a high breakage rate per foot of hole.

2. **Maintenance.** The errors mentioned are inevitably aggravated by worn machine parts. Unfortunately, pneumatic drills and accessory equipment are often so badly in need of repair that good drilling is impossible. In these cases, drill-rod

4. BY PROPER FORGING the lapping which is visible at the bit wings and the fatigue cracks that have developed in the rod just back of the bit end could have been avoided. Here, also, etching in hot 1-to-1 hydrochloric acid and water developed the cracks and revealed the laps.



A B

5. PROPER FORGING AND FILING before hardening gives a detachable steel bit like that designated as "A". Bit B shows results of poor forging. Use of too large a punch and dolly pin has caused splitting. The end view of B bit is shown in the upper right, that of Bit A below it.

failures can be expected quickly. Photograph 1 shows a drill shank with worn lugs and rounded striking end. Rounding of the striking end was caused by a cupped drill piston. The battered lugs were caused by a worn chuck bushing and the chuck end being 3/16 in. too long.

The latter feature shortens the piston stroke and reduces drilling efficiency of the rod without reducing stresses. Careless workmanship is responsible for the surplus length; the shank should have been ground to correct length before use. Discrepancies of this sort work in a vicious circle—an improper chuck end on the drill rod causes excessive chuck wear. Soon the chuck is wrong for correct drill rods and good shanks are spoiled. If the drills are then used in other machines, the cycle is continued. The cure, of course, is systematic inspection and repair of drill rods and machines.

3. Improper air pressure. Pneumatic drills are designed to operate best in a certain range of air pressure, somewhere between 80 and 105 psi. Working at lower pressure results in the drill rod absorbing hammer energy that is ineffective in cutting rock. The rod is literally "shaken to death" without much hole footage to show for it. On the other hand, high air pressure increases drilling speed at the expense of drill rod and bit life. A bit can chip a certain maximum amount of rock per blow, and any piston energy left over is wasted. It must be absorbed by the drill rod, and the result is early drill-steel breakage.

4. Dull bits. Although this topic should not require mention, a great many drillers continue drilling after the bit is dull and until it binds in the hole. After a certain amount of time, a bit drills so slowly that almost no useful work is performed and again the drill steel must absorb the punishing blows of the piston.

5. Surface damage. In use, even with excellent drilling conditions, hollow steel drills are subjected to very high stresses each time they are struck. If there are deep tool marks or dents on the surface of such highly stressed drills, the stress is not distributed uniformly, but is concentrated at the damaged spot. One conscientious driller, whose name contained a number of H's, marked 100 drills by chiseling his initials into them. His 100 drills broke through the initials as they were used.

Pipe wrenches and sledge hammers are almost as effective as chisels in making stress-concentrating marks. Throwing drill rods together in a pile is very likely to result in this kind of damage. Photograph 2 shows a typical failure. The fatigue crack originated and progressed across the bar from a nick produced in handling. (Hot etching in 1:1 hydrochloric acid and water at 180 deg. F. brought out the fatigue crack which started in the dent.) Considering the high cost of tools and labor in setting up a jumbo or ordinary drilling rig, avoidance of such damage will pay dividends. Rods used with detachable bits are no less sensitive than conventional drills to the effects of stress concentration.

Fabricating Techniques Frequently Ignored

Only things which shorten the life of even the best fabricated drill rod have been discussed so far. Proper forging and heat-treatment of the drill steel are perhaps even more important. Poor practice anywhere along the line will cause trouble, but a combination of bad fabricating and drilling techniques is sure to result in miserable performance.

All parts of the fabricating phase cannot be discussed here, considering the many types of bits in use and the successful application of alloy steels in many places. However, there are general recommendations which should be followed regardless of the steel or bit used, although it should be emphasized that the manufacturer's data sheets and the recommendations of the field representative should be adhered to carefully if the full value of the drill is to be realized.

Shank or Chuck Ends. Most of the failures in collared or lugged shanks can be traced directly to improper forging or heat-treating techniques. For example, a break through the middle of the collar of a jackhammer rod, or one directly through both lugs of a Leyner shank can safely be laid to bad forging. Too much metal was upset to form the collar, or lugs, and opening the hole left a weakened center. When too much metal is taken for the collar or lugs, there is no way to get rid of it except to scrub it out with the shanking pin

or punch, and that leaves a rough, torn central surface that is a stress-raiser. A fatigue crack starts and progresses rapidly toward the outside. The crack follows the middle of the collar or lugs because there the flow lines of the upset steel have been pinched together and weakened. This condition may be avoided by the following procedure:

Four Operations

1. On the first heating, drive a punch of the proper size for the size of the section being worked into the end of the steel to a short distance beyond where the collar or lug is to be upset. Remove the punch and upset in the dies. This preliminary upset should be small. For example, on 1-in. hexagon bars, the greatest diameter across the flats would be about 1-1/6 in.; slightly more for 1¼-in. bars, less for ⅞-in. bars (Operation 1).

2. Forge the drill back down to original size of bar (Operation 2).

3. Reheat, and on the second heating complete the upsetting operation and sizing of the lug or collar (Operation 3). Note: only enough steel is upset in this operation to all but fill out lugs or collar.

4. Reheat, and on the third heating again drive the punch through the lug or collar to open the hole to proper size and then again size the collar or lugs and the end of the steel in the dies. In this manner, the punch forces the metal constricting the hole outward to fill the collar or lugs. Final sizing brings collar or lugs to exact size. Flow lines in the steel of lugs or collar are gradually curved without wrinkling along the outside surfaces, and they are straight next to the hole wall.

After forging, the heat-treatment will depend upon whether or not the rod is an alloy grade or of the controlled-carbon type. In any case, the overlapping and gradation of heats should be observed. Simply stated, this means nothing more than avoiding a sharp line of demarkation between hardened and unhardened zones after quenching.

The group of photographs numbered "3" (p. 74) shows, at "C," the result of improper heating for hardening. This sharp drop in hardness may be minimized as follows: After holding the rod in the furnace or lead or salt bath at the proper temperature and time, insert another two or four inches of it for a few minutes if furnace heating is used, or a few seconds in the case of salt- or lead-bath heating, then quench. The exact time will depend on size of rod and rate of heating.

Picture A in this group shows a longitudinal section of 1¼-in. round shank end of controlled-carbon hollow drill so heated before quenching. Picture B shows the same gradual transition of hardness, except that at the right end there is a soft zone remaining from the normalizing operation. This region should have been overlapped by the final hardening heat. A soft zone is larger and softer the longer the steel soaks in the furnace without advancing after the end has reached temperature. Soaking more than five or ten minutes after the desired part is up to temperature is also undesirable because it increases the scale and surface decarburization or "soft skin" frequently found on the surface of hardened shanks and bit ends.

Bit Ends. The bit end of the drill calls for the same heating technique described above before hardening, irrespective of the kind of bit to be used. It must be emphasized that when detachable bits are used, the connection must be made to conform exactly with the bit manufacturers' drawings. Otherwise, premature fatigue failures will occur somewhere in the connection. In addition to matching the drawings to insure proper filleting and dimensions, the finish must be as smooth as possible. A torn gouged surface is just a mass of stress raisers. Grinding the connection assures a smooth surface, but if the rod end is machined, the steel must be annealed to a hardness capable of a smooth finish.

Precaution on Annealing

The standard shop annealing method of slow cooling in some insulating material can be entirely satisfactory provided one or two precautions are observed. First, if any forging is performed prior to machining, that end should be allowed to cool in air after forging at least until black. Then it should be reheated to slightly above the critical temperature in the case of controlled-carbon steel (or as recommended by the steel manufacturers for alloy types), and then put in mica, ground asbestos or similar good insulating material and cooled slowly. Simply allowing to cool slowly from the forging temperature does not produce the best hardness and structure for machining, although it is faster, and steel of the controlled-carbon type can be machined by this method.

Second is the matter of cooling. This is very important, especially in the case of alloy drill steels. Best results are produced only by a very slow cooling rate, and that can be had as follows: Use a large quantity of good insulating material, close pack as many rods in the center of this material as possible and allow to cool at least overnight. A good practice observed by some shops is to put the rods into the insulation early in the afternoon of one day and have them cool slowly until the morning of the next day. This allows about 16 hours for the cooling process, and when the rods are removed, the ends should still be too hot to handle comfortably with bare hands.

Avoid Cracks and Laps

Bits Forged on the Rod. Some mention should be made of bits forged on the drill rod, even though these so-called conventional rods or steels are not so widely used as they were a few years ago. In forging bits, great care must be taken to avoid the formation of cracks or laps in the forming operations. One of the most frequent causes of failure in bits of this type is splitting by punching with too large a punch. Photograph 4 shows a bit that is badly lapped in the wings. This was caused by using too small an upsetting dolly, and subsequent sizing operations folded in the fins produced at the wing tips. This bit lost its gage much too rapidly because the wing tips were not sound. Drilling dull promoted the fatigue cracks seen as transverse parallel lines just behind the bit. These were brought out by etching in 1:1 hydrochloric acid and water. When such cracks are as large as this, heating for resharpening will open them up so they can be seen by the naked eye. The bit B in the group numbered "5" shows splitting as the result of using too large a punch and dolly pin, also some laps which should have been filed out before hardening. Picture A in this group shows the same size bit properly forged and filed for hardening.

When hard rock operation has chipped and broken the bit wings of a drill, the whole bit should be cut off instead of attempting to sharpen it. After forging, bits should be allowed to cool off naturally in still air before hardening. A bit should never be sharpened and hardened with the same heat. In heating dull bits for redressing, no more of the end should be heated than is necessary to fill out to size once more.

INSIDE YUGOSLAVIA—II

The Trepca Mine's Great Possibilities

Jack Christie, McGraw-Hill World News man in Germany, went to Yugoslavia recently to see for himself, and for E&MJ's readers, what Marshall Tito had done with the country's metal mines. This is what Jack saw at the famous Trepca Mine.

JOHN J. CHRISTIE
Frankfurt, Germany[1]

WITHOUT A DOUBT, Marshall Tito picked up one of the biggest metal mine bargains of all time when he took over the Trepca lead-zinc mine from the defeated Nazis. Trepca has good ore, a lot of it, and it has had the reputation of being the lowest-cost lead producer in the world.

Tito now wants to enhance this reputation by modernizing and mechanizing the mine and stepping up its output. He looks to the United States for both the money to do the job and the market for the major part of the metal he'll produce.

Actually, Trepca, of course, was the property of the British mining firm, Selection Trust, Ltd. In the opinion of some, it still is. However, Selection Trust has had no contact with Trepca since 1941. At prewar price levels, Trepca was worth about £7,000,000 when the British firm last saw it. This probably made up about half of all British assets in Yugoslavia that were seized at the war's end.

The Yugoslavs and the British did get together finally on an agreed compensation for Trepca of £4,500,000. Only about one-tenth of this has so far been paid to the British Government, and none of it at all has gotten back to the one-time owners of Trepca. Naturally, they take a somewhat biased view of the situation.

Trepca Mines, Ltd., according to its own prewar records, was the world's lowest-cost lead mine. In 1933, for example, cost of production of lead ore was 14s. 4d. per ton (about $2.85). For Broken Hill, Australia's chief producer of lead, costs at that time were running about 30 shillings per ton of ore.

Abundance of cheap labor was, of course, the basic reason for Trepca's low costs. Added to this, however, were other factors like the extremely low royalties exacted for mining rights, and the liberal concessions granted on import of machinery, export of profits, and the like. This made for large scale exploitation of Yugoslavia's natural resources, but it retarded the development of even a rudimentary industrial economy. The Yugoslavs are now highly conscious of this lack and may be over-critical in their thinking about it.

This feeling that their country has been exploited in the past by their "capitalist enemies" may explain in part the success of Tito's variety of Communism in taking over the country. Yugoslavia, after years of producing industrial raw materials, was ill-equipped to make its way as an independent nation. Tito's talking point is that under "socialism" he will correct that error.

Trepca's Capacity

Virtually all activity of Trepca (pronounced TREP-cha) is at the Stan Trg mine about 6 km. from the town of Zvecan, where the mill, power plant, smelter and refinery are located. Zvecan is about 180 miles south of Belgrade on the Ibar River. The main rail line between Belgrade and Salonika goes through Zvecan.

The present regime punishes severely anyone releasing production figures, but by carefully cross-checking estimates, I concluded that the Yugoslavs are producing ore at Trepca at about the prewar rate. This means a minimum of 600,000 tons per year. In 1940, production ran over 700,000 tons of ore.

This output can be considered an achievement in the face of the miserable state of the mine's equipment. Three production shifts are working the mine, against the prewar two. In 1941, the Germans took over the mine from the British and ran it thereafter without regard for equipment or logical mine planning. They grabbed for the highest grade ore, and they flooded part of the mine when they retreated.

The Yugoslavs have had to struggle along at Trepca with the equipment as the Germans left it. A few drills came through as part of German reparations, but nothing significant. Out of a recent Export-Import Bank loan to Yugoslavia ($20,000,000), Tito has allocated $2,700,000 for mine, mill and smelter equipment for Trepca. The first of this equipment should begin arriving about mid-year.

Orders placed in the US for mining equipment for Trepca include: 917 drills with supply of steel bits and spare parts; 35 scrapers; 17 electric and 24 air hoists of one and two drums; three centrifugal pumps; 22 electric locomotives for underground haulage and two diesel locomotives for transporting ore from shaft to cable railway at Trepca mine; 400 tons of rails; 40 tons of piping; 50 tons of steel rope; 50 tons of NKRA cable for shafts and inclines, plus large quantities of high voltage telephone and rubber cable. The order includes a number of large electric motors for heavy operations, the Yugoslavs being able to provide their own small motors out of domestic production.

Lead shipments, representing chiefly Trepca output plus some from the Zletove mine in Macedonia, to the US alone were valued at $7 million in 1949. Copper shipments to the US were valued at $5 million. (These shipments, however, do not represent a quid pro quo for the non-ferrous mining loan, which by coincidence happens to be the same amount.) The Yugoslavs have a target of 700,000 tons of ore from the Trepca mine alone in 1950. It is not certain to what extent this goal is predicated on getting new equipment. However, it is certain that some new equipment will be in use the second half of this year.

Basic facts on British development of the Trepca mine (E&MJ, Sept., 1946) are: Vertical extent of the orebody exploited prewar ranged from 830-meter level to 435-meter level. (Levels based on sea

[1]McGraw-Hill World News Bureau, Frankfurt, Germany.

level as datum.) Exploitation carried out in three stages: (1) By adits above the 760-metal level, (2) by vertical shaft from the 760 to 610 level, and (3) by internal inclined shaft below the 610-meter level. The 760-meter level is that of the valley bottom, site of the ropeway terminal to the mills, compressor plant and shops. The 610-meter level is the point at which the deep dewatering supply adit intersects the mine workings.

The 610-meter level is known as Horizon 1. The British also developed Horizons 2 at 545 meters, 3 at 485 meters, and 4 at 435 meters. The pump chamber in preparation for opening Horizon 5 at 375-meter level was completed shortly before the war. Development of Horizon 5 has been carried on since the war by the Yugoslavs. They also installed a pumping station for Horizon 6, which was opened just recently at the 315-meter level.

Horizon 5, level of main activity now, contains about 10,000 square meters of ore surface. Ten different orebodies comprise the horizon, one of which covers 5,000 square meters.

Stoping continues to be by horizontal cut-and-fill method, except where weakness of particular sections require square set and fill. Yugoslav engineers apparently would prefer square setting as regular practice.

Stone Chutes Planned

The Yugoslavs have begun to make certain alterations in preparation for increased mechanization. They are increasing the size of and changing the position of chutes to permit use of scrapers in the stopes. The British experimented with scrapers but apparently made no serious effort to convert due to abundance of cheap labor. Yugoslav engineers also plan to make their chutes of stone construction instead of wood. The British experimented with concrete chutes but apparently the idea proved unworkable.

Latest data on ore reserves as supplied to US missions investigating loan applications (neither the mine management, nor the Ministry of Mines is permitted to disclose such information, except for such purpose) for the Trepca mine is as follows:

Visible reserves (including Horizon 5): 3,770,000 tons with 7.6% lead, 4.6% zinc and 124 grams silver per metric ton. Probable ore: 2,160,000 tons with 7% lead, 3% zinc and 100 grams silver per metric ton. Possible ore: 4,320,000 tons with approximately 5% lead, 2% zinc and 80 grams silver per metric ton. Total: 10,250,000 tons.

Kapaonik mine: Visible: About 800,000 tons with 9% lead, 6% zinc, 3% arsenic and 117 grams silver per metric ton. Five horizons above sea level have been worked at Kapaonik. Reserves below sea level aren't proved.

British made explorations at Novo Brdo, near Kapaonik, before the war. Reserves are: Visible: 300,000 tons with 5% lead, 11% zinc, 108 grams silver per long ton and 2.7 grams gold per long ton. (Although other orebodies have traces of gold, this is the highest yet proven in this area.) Probable reserves given as 50,000 tons of uncertain metal content.

Ajvalja, which was owned by the French interests controlling Bor, was not as well investigated as Trepca holdings. It has an estimated 350,000 tons of ore with perhaps 7 to 8% lead and 15% zinc. Roughly this represents 170,000 tons visible, 80,000 tons probable, and 100,000 tons possible.

Another proven reserve is the Zanjevo. This comprises two orebodies. The Prelina District has 140,000 tons visible, 200,000 tons probable, and possible reserves.

The Kisnica District contains a large quantity of decimated ores estimated at about 3,500,000 tons, which may have a metal content of 3% lead and 1.4% zinc. The area would be suitable for open cast workings.

Only other lead-zinc mining operation other than Trepca is at Zletove in Macedonia. As before the war, Zletove lead concentrates are sent to Trepca smelters. On the basis of prewar figures, Zletove output of ore couldn't have been more than around 150,000 tons.

Most emphasis has been placed on expansion and improvement of the smelter, which, together with a refinery the British put into operation in 1939. The smelter was built with a capacity of 20,000 tons per year.

The Yugoslavs are in process of adding nine Newman hearths to the battery of six which the British installed. Three of the new hearths, said to have been produced domestically, are now working. A Dorrco-type filter also has been added.

The building housing the Newman hearths has been enlarged to provide more working space and better ventilation. Men on the furnace are working one hour on and one off for a total of four production hours in a single shift.

A most unexpected finding is that improvements have been made on the automatic rabbler of the Newman open hearths, which it is claimed enable capacity per unit to be increased from 12 to 18 tons per day. The technical changes, for which a patent has been applied, are the work of German-educated Engineer Milan Jovanovich, who is in charge of smelting operations.

His changes consist of increasing thickness of gear teeth and chain links from ¾ in. to 1 in. of altering the mounting of gears to facilitate better lubrication and of strengthening axles. Claimed results are better operation of the hearths and a minimum of stoppage for repairs.

Smelter to Be Enlarged

According to claims made for improvements on the Newman hearths, the Yugoslavs now should be able to produce about 162 tons per day on the basis of nine hearths having an output of 18 tons each. The British, on the other hand, would have been producing 72 tons per day on the basis of having six hearths with a capacity of 12 tons each. (The figure of 72 tons per day dovetails with the 20,000-ton annual capacity reported by the British.)

Ground is now being cleared for construction of a large addition to the smelting plant. Now stored pending completion of construction is equipment purchased from Lurgi of Frankfurt, Germany. This includes a new blast furnace 4.5 by 1.25 meters for treatment of gray slag, a 22-meter sintering machine and two new electric filters, one for the sintering machine and one for the blast furnace.

Concentrate from Trepca ore runs just under 80% Pb, while that from Zletove has around 70% Pb. Kapaonik lead concentrate is too high in arsenic content to be treated Zvecan because of danger to the workers.

Gray slag from the Newman hearths was sold before the war. But the Yugoslavs are now storing it pending installation of the new blast furnace.

The lead refinery has had no expansion. Some of the equipment, notably the molten lead vessels, is badly in need of replacement.

Zinc concentrate, as before the war, is shipped to foreign smelters. The Yugoslavs are planning to erect a zinc smelter but it may be some

time before they can get the necessary installations.

Equipment ordered from the US under the Export-Import Bank loan for the mill, smelter and refinery includes: Three ball mills for the mill; blankets for flotation machines; a 1.3-cu.yd. crane for blast furnace operations; three vacuum filters; vessels for the refinery and conveyors to transport lead bullion to the rail sidings.

Labor at Trepca

The working force at Trepca is composed largely of so-called Shiptars, people of Albanian origin who settled this part of southern Serbia which is not far from their country's border many years ago. Their almost barren land produced a low standard of agrarian living, which deteriorated further with increased population. But the Shiptars are not a migratory people and tended to accept their lot. They took to the mines as an alternative to growing hardship on the land, accepting low wages as a matter of course.

Although foreign capital found ample cheap labor all over the country prewar, the British had in this area a particularly plentiful and stable source.

The appearance of the miners at Trepca today seems to indicate that the Tito regime also is taking advantage of the Shiptar tradition. For these miners seem to be at or near the end of the line on distribution of miners' suits and shoes and consumer goods.

Attire at the pit, as well as outside, is generally traditional peasant makeshift. Patched and tattered garments and sandals for footwear are commonplace. Of course, due to the intense heat in the lower levels of Trepca, men work stripped down to shorts. Carbide lamps are carried. Helmets are more the exception than the rule.

The government has adopted a program of free issue of miners' suits and shoes, replaceable every six months. It just hasn't been implemented yet at Trepca or, at least, not to an appreciable extent. But at the Bor copper mines, also inspected on this trip, the miners were noticeably better clothed and equipped and more consumer goods were in evidence. The seriously higher labor turnover in the Bor area makes the need for more incentive at Bor self-evident. (See *E&MJ*, May, 1950.)

As in all mining areas, money is more plentiful at Trepca than prewar. The dire shortage of consumer goods, though, takes the edge off this. Unless something can be purchased with a coupon, the price is astronomical. Food and rent are at very low controlled prices.

An experienced driller gets 33 dinars per hour. That would be $0.66 at the official rate of exchange. But the relationship between the dinar and foreign currencies is so fictitious that the figure is meaningless. But, for the sake of comparison, a helper on the drilling machine gets 22 dinars. Loaders and others in this classification get from 16 to 24 dinars.

There is ample opportunity to get piece rates and production bonuses, either single or in groups. Thus, some miners are said to have gotten up to 30,000 dinars a month. Theoretically that would be $600. Actually, it wouldn't be enough to buy a new mattress on the open market.

Higher wages, then, represent more of a promise of a better deal than prewar, rather than a fact. But, before the war, Yugoslav labor was treated on a strictly colonial basis so there wasn't even the promise. The Tito regime also has put in social security and a system of paid holidays.

Toward its goal of providing a better standard of living, the Tito regime has made its best showing in housing. Fortunately, the country is well off for building materials and can do more on this score than on consumer goods.

In the case of Trepca, the British had built a more or less self-contained community including houses, hotel, eating and recreation halls. Still there was room for better housing, and the Yugoslavs have done considerable, although activity was slowed up at the time of my visit by cold weather.

The new housing is substantial. Two-family plaster-covered brick bungalow-type houses are being built for family occupancy. For the single men there are new standard type barracks, each containing 40 rooms. At present, two miners must occupy one room, but when more buildings are up, they will have singles.

The miners go at their work with reasonable diligence. Due to their background, a more or less fatalistic acceptance of conditions could be expected anyhow. It probably doesn't awaken any special enthusiasm, but anyway stirring music and propaganda is always on the air. Loud speakers are posted all over the community around the mine and the works at Zvecan.

Relationships between the men and bosses are uniformly cordial. And mine discipline can be considered reasonably good here.

Management and technical direction constitute a problem at Trepca as at every other mine and industrial enterprise. The shortage of native know how, both managerial and technical, is inevitable in view of over 90% of Yugoslavia's nonferrous metal mining having been foreign-owned before the war. Available trained technicians are parceled out as though they were gold. German technicians are strategically placed. Many of them are ex-PW's who were offered jobs in return for discharge.

The top man or director here as elsewhere is a figurehead in the sense that he is not a mining man. Many mine and factory directors were war heroes in the partisan movement, but in any case they are tried party men. In the case of Trepca, the rest of the top echelon of management consists of young, intelligent and willing men with some but, by their own admission, not enough experience. The best trained or experienced men are on the operational level.

One or two of the oldtimers who had responsible prewar positions provided an interesting sidelight by their comments in praise of the ability of the British engineers responsible for the development of Trepca mine. Their comments, however, were in no way meant as a reflection on Yugoslav ability to carry on the enterprise.

Tools Will Boost Output

Regardless of the fact that technical and managerial direction isn't up to prewar standard, the Yugoslavs should be able to boost production when they get the tools. For here it is mainly a problem of replacing equipment that is worn out. Providing more drilling equipment and electric locomotives for haulage and replacing hand shovels with scrapers obviously aren't going to require a full-dress technical assistance program.

Improvement of an enterprise like Trepca mine is a much different proposition from establishing new industries for metalworking and chemical production. For there is some tradition for mining, but almost none for factory-type production. That's why Western credit policy puts emphasis on mining, forestry and agriculture and won't underwrite all of Tito's ultra-ambitious Five Year Plan.

PERLITE DEPOSITS, such as this in southern Colorado, are relatively easy to mine by conventional open-pit methods. The ore is sized and shipped to "popping" plants in Colorado and elsewhere in the United States.

Perlite Mining and Processing—

The rise of perlite from a glassy petrographic curiosity to a major industrial mineral within a decade has aroused much interest in the origin, geology, beneficiation, and marketing of this non-metallic. The authors discuss these subjects with the qualifications of men who have pioneered in the perlite industry and are making it pay.

ROBERT D. WILFLEY[1]
and CLARION W. TAYLOR[2]

THE LARGEST MARKET so far developed for perlite has been in hard wall and acoustical gypsum plaster, but it is rapidly pushing into the fields of monolithic and pre-fabricated concrete, loose-fill insulation, hot and cold surface insulation, roof decks, concrete brick and blocks, filtration and many other more specialized applications.

Alexite Engineering Division, of Colorado Springs, Colo., was one of the first companies to investigate the possibilities of perlite, and the geologic department has done extensive exploration in many western states. Currently, company mining operations are confined to Colorado. Ore produced here carries the trade name "PerAleX."

Perlite is a member of the obsidian family of rocks and was formerly defined as an acidic volcanic glass, being essentially an amorphous aluminum silicate. Ralston[1] of the Bureau of Mines defines perlite as "any siliceous lava containing dissolved water in sufficient amount to expand into bubbles when the material is quickly heated to a suitable point in the softening range." In other words, Ralston would include not only the acid but the mafic (basic) obsidians and their group members.

Our geologic department is in agreement with this definition and would add that perlite may be an alteration product of lavas, using lava broadly to include tuff, pumice, etc., as well as the popular conception of flow materials. We would, therefore, define perlite as any siliceous material that "pops" when heated to a suitable point in the softening range.

This theory is of practical value because it indicates that we no longer need look only into rhyolite areas for perlite, but we can consider areas of basalt (known for their basic obsidians, such as tachylite) and basic pitchstones as interesting prospecting areas. Further, it points the way to investigation of the andesitic and dacitic perlite deposits, including also their associated obsidians and pitchstones. This new postulate has proved of working value to our geologic staff and has assisted in discovery of many new perlite deposits.

Geology

Western perlite is largely associated with tertiary volcanics and probably is a result of the quick solidification of lavas which, if slowly cooled, would become crystalline and would be called trachyte, rhyolite, etc. Natural glasses are

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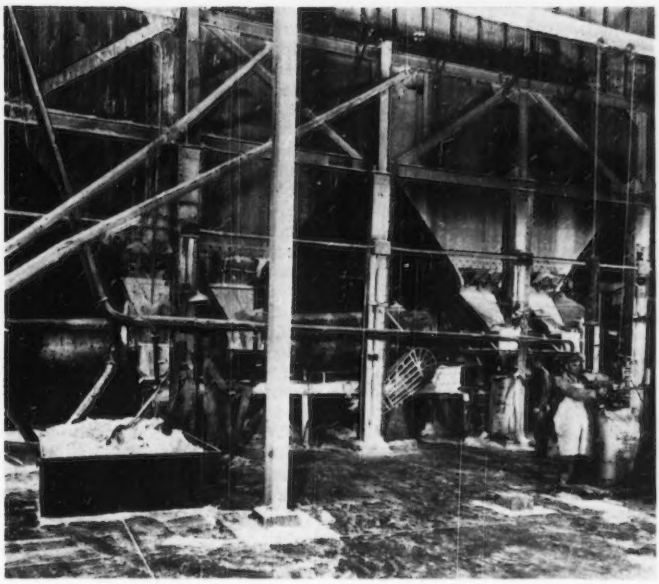

ALEXITE FURNACE OPERATIONS at Colorado Springs, expand perlite. More than 30 plants are now in operation in the United States and Canada.

Chemical Analysis of "John-Clare" Perlite Ore

Chemical Analysis	Percent	Mole Number (Percent divided by molecular weight)
SiO_2	69.79	1.163
Al_2O_3	14.72	0.144
Fe_2O_3	2.07	0.017
MgO	1.08	0.027
CaO	1.49	0.027
Na_2O	2.79	0.045
K_2O	3.98	0.043
H_2O (incl. ign. loss)	4.00	
Cl	trace	
SO_3	trace	
MnO_2	trace	
Total	99.88	

Calculated Norm	Percent
Orthoclase (K_2O, Al_2O_3, $6SiO_2$)	23.91
Albite (Na_2O, Al_2O_3, $6SiO_2$)	23.58
Anorthite (CaO, Al_2O_3, $2SiO_2$)	7.51
Magnesium Metasilicate (MgO, SiO_2)	3.32
Hematite (Fe_2O_3)	2.07
Corundum (Al_2O_3)	1.94
Quartz (SiO_2)	33.54
Water (Plus) and ignition loss	4.00
Total	99.87

Norm agreement with chemical analysis = 99.87 : 99.88 = 99.989 percent.

A New Industry for the West

generally regarded as extrusive, but Wilson[2] questions this extrusive character, stating, "It is difficult to understand how glass, such as perlite, containing sufficient water or gas to make it expand or explode when heated, could solidify under atmospheric pressure without expanding into pumice or exploding into tuff. Even if the water or gas is assumed to be present as components that unite upon heating, what would then keep them from escaping? As suggested by B. S. Butler, the water might be retained if the molten glass were intruded as near-surface sills, sheets, or dikes, which would permit rapid cooling under pressure."

Field studies indicate that perlite is a surface or near-surface deposit and therefore must have had a different origin than generally accepted. We believe that perlite is of secondary origin, possibly the result of hydrothermal alteration of a siliceous rock, such as pumice, tuff, etc., its formation being somewhat analogous to opalization. Obviously, a surface deposit, or near surface igneous deposit, having a high water content (such as perlite, pitchstone, etc.) should show vesiculation, or the material should have "popped," for even at depth, Eskola[3] says that "the dikes of Sviatory Noss carried bubbles to a depth of more than 1,000 meters."

We cannot reconcile the "quick chill" theory of the genesis of perlite because of the difficulty of quick chilling a large mass. An illustration ready at hand has been furnished by Koenigsberger,[4] who mathematically showed that a mass of acidic lava 100 meters thick (about the thickness of one Colorado perlite deposit examined by our staff) would require 300 years. Cooling over this period of time would almost certainly produce a crystallized mass. In 1805, Hall[5] noted that slow cooling of green bottle glass "lost every character of glass and had completely assumed the stony structure."

Although the word glass has been applied to the natural glasses (due to their appearance), the latter are not true glasses because, as Hall observed, a true glass being melted and quickly cooled resumes its glassy state, and when slowly cooled assumes a stony state. Our observation is that the natural glasses upon being melted and quickly cooled produce a pumice or cinder in no way resembling the original material.

It might be argued that the presence of water in lava or magma would cause the formation of perlite, obsidian, or pitchstone. Daubree,[6] prior to 1861, checked this very thing by heating obsidian with water in a sealed tube to a dull red heat, and the resultant product was of a crystalline structure having the nature of fine-grained trachyte. Daubree's experiments show that the presence of water favors the formation of crystalline silicates at temperatures much lower than their point of fusion.

Further, Dana[7] states, "Any glass, if subjected in a furnace to a bright red heat (short of the heat of fusion) for 3 or 4 weeks will pass more or less completely to the lithoid or stony state; that is, become devitrified or converted into stone." In 1816, Cordier[8] stated that "the materials of the interior lava flows (those of obsidian excepted) crystallize entirely by cooling."

Our field staff has observed an unusual perlite deposit cutting through walls of granite and schist

near Nathrop, Colo. Although most of this deposit is only from 4 to 8 ft. wide, at one place a lens of perlite is some 30 ft. wide. On the footwall side of this lens there is a porous rhyolitic rock some 20 ft. wide. It appears that the whole deposit was originally of this porous material, and that hydrothermal action altered the hanging wall side to perlite. If the quick-chill concept was correct, then the perlite should have been on both walls with the rhyolitic material lying between.

It might be argued that the presence of phenocrysts or inclusions in various perlites is indicative of the liquid flow origin of the perlite. However, phenocrysts of feldspars, micas, and other silicates, and inclusions of gneiss, schist, etc., from the walls of the volcanic vents are common in pumice and tuff, and also in perlite. The inclusions of gneiss, schist, etc., in perlite show no effects such as would be expected if dropped into a mass of molten glass. Hence, it would appear that the inclusions mentioned were formed prior to the magmatic flow, and, conversely, if they did crystallize in the flow of material, this would still indicate slow cooling and not fast cooling, as previously attributed to perlite. Daubree included pieces of feldspar in his steam-pressure chamber with obsidian and noted that the feldspar was not noticeably acted on. He concluded that silicates which originally crystallized in conditions similar to those in which they were again placed are very stable.

Perlite—An Altered Pumice?

At several deposits we have noted bomb-shaped ovals that were undoubtedly pumice originally as they show long-grain structure typical of pumice. The material is now quite glassy (a perlite), and is an example of alteration of pumice to perlite. In every case that we have observed or read about it would appear that the perlite may be an alteration of pumice or tuff. In every instance there is (or was) a more or less impermeable capping which could have held hot waters or vapors, resulting in perlitization. Where vulcanism has taken place in the sedimentaries it is quite possible to find perlite (possibly an alteration of pumice). We have found two deposits of this nature where it appears that pumice was waterlaid in a lake or stream and later covered with a flow-rock capping, and subsequently exposed by tilting and erosion. The deposits (not consolidated) are possibly due to the paucity of alteration solutions and vapors.

We do not claim that perlite formations are always the result of hydrothermal action. They may also be the result of some type of alteration of pumice, tuff, or other porous siliceous rocks. Furthermore, the absence of rare elements would indicate that perlite is definitely not a residual magma.

Perlite sands have presented somewhat of a problem. In our opinion they are due either to the alteration of pumicite *in situ* or to a phreatic explosion (no incandescent matter) of a previously existing perlite deposit. Our Colorado Polvo-Blanco deposit is definitely aeolian. More than 50% of this perlitic material is minus 200 mesh (74 microns). This material lies on a sedimentary base several miles from the nearest eruptive area. Under the microscope, the Polvo-Blanco fines are sharp, angular, glassy and show no vesiculation. If this material had been blown molten from a volcano it would have "popped," and we would now have vesicular or spongy particles. Daly[9] observed at Kilaueo Lake in 1909 that vesiculation took place almost completely before the splashes "froze" to the wall of the crater, which is in accord with our concept that a molten glass blown from a volcano would have to be vesicular. While the Polvo-Blanco is an unusual deposit, most perlite deposits are fairly hard and compact, and require crushing and sizing before furnace treatment. On heating to 1,800 deg. F., this material expands into innumerable bubbles with shell thickness so thin that they were iridescent.

Mining Is Simple

Perlite is not difficult to mine and may be exploited by open pit or underground methods. Our operations at Rosita are open pit. Holes are drilled with jackhammers and detachable bits to a depth of 10 to 12 ft. The average use for each sharpened bit is 100 ft., which indicates the ease of drilling. The ore shatters easily, and no secondary blasting is required. Holes are placed 5 ft. from toe to bench on 5-ft. centers. Faces are from 8 to 12 ft. high. A compressor, two jackhammer-type drills, a ¾-yd. diesel shovel, and a tractor comprise the mining equipment. Loaded holes are detonated with electric blasting caps.

Broken ore is removed by shovel to a Cedar Rapids crushing and screening plant to be reduced to a tail of 1½ in. Subsequent treatment in a 40x20-in. roll yields a two product material which passes over a 4x12-ft. deck screen. The plus 8-mesh material goes to a secondary roll, while the minus 8-mesh material is eliminated at this point to a stockpile as concrete aggregate. The different screen decks make it possible to cut or increase different amounts of minus 30 or minus 50-mesh material, as desired. Secondary roll product, minus 16 or minus 14-mesh material (or desired maximum) is passed to a 3x10-ft., three-deck screen, the end product being plaster aggregate produced at a rate of 36 tons per hr. These figures are somewhat tentative but have been set up by Jack Green, chief engineer, as to possible potentials, the planned average daily production per shift is calculated from 4 to 8 carloads (200 to 400 tons) of perlite aggregate. The minus 30-mesh material skimmed off the different screen, except that portion permitted to pass, constitutes the third aggregate produced, known as fines.

All ore is trucked to and shipped from Texas Creek, Colo., to furnaces. The company currently is supplying 18 furnaces and has 75 applications or inquiries concerning furnaces or ore. The industry is definitely on the move.

More Study Needed

Much remains to be learned relative to improved methods of sizing because: (1) Various sizes are demanded for different uses; (2) different ores with their variable characteristics react differently with heat treatment; and (3) different furnaces require different ore sizes. While there has been no standardization of ore sizes in the industry as yet, our company and its raw ore customers have found the following sizes satisfactory for PerAleX ore:

No. 1. Concrete aggregate ore: Minus 8 plus 30 mesh (15% plus or minus).

No. 2. a. Plaster aggregate ore: Minus 14 (or minus 16) plus 50 mesh (15% plus or minus).

b. Plaster aggregate ore: Minus 20 plus pan (maximum 25% minus 100).

No. 3. Fines: Minus 30 plus pan (maximum 10% plus 30).

In addition, various fine sizes are sold for a wide variety of purposes.

In the industry, all ore is classi-

fied into the categories, namely, (1) lively ore; (2) intermediate ore; and (3) dead ore. According to Murdock and Stein,[10] "Lively perlites always have low softening temperatures and lower effective water contents. These softening temperatures run from 1,400 deg. F. to above 2,000 deg. F., and the effective water contents run from over 2% down to 0.2%." Tests by King, Todd and Kelley[11] reveal some interesting facts relative to water in perlite. Extensive tests reveal that the bulk of water in perlite is relatively loosely held, but "as dehydration proceeds, the residual water is held progressively more firmly." It appears that the combination of heat of solution and high temperature heat-content data provides a basis for energy requirement calculations in processes for expanding perlite.

Water Does the Popping

The types of measurements done by King, Todd and Kelley show that water above 1.2% in perlite is loosely held and removable. Water below this percent (perhaps considerably below) is the only water effective in perlite expansion. Heat of solution measurements indicate that water up to 0.5 or 1% may be considered as comparatively firmly held. The "effective" water refers to the tightly held portion of the water content (that portion assisting intumescence), and does not refer to all of the "plus" water content of the perlite. The actual water that does the popping (or that assists in the popping) must not be confused with the total plus-water content of the so-called "natural glasses," which have been attributed to pitchstone (5% or more plus-water), to perlite (2 to 5%), and to obsidian (less than 1%). A lively perlite ore produces an expanded product of greater friability than a dead ore, although it is indicated that proper furnace treatment might give increased strength to certain friable ores.

Our laboratory has done considerable research to correlate "popping" temperatures of perlite to the chemical analysis without avail.

A study of the norm correlated to popping temperatures may prove of inestimable value to efficient perlite expansion and could reflect itself in the production of superior aggregate by correct determination of popping temperatures, saving of Btu.'s, and others. More, a study of the norm of one perlite against other perlites could possibly reveal why certain perlites are stronger than others after expansion. Much remains to be determined about such variations in strength.

The accompanying table by E. G. Zost[12] shows the chemical analysis and calculated norm of "John-Clare" ore (a Colorado rhyolitic perlite, which, because of its lightness and unusual toughness after expansion, is one of our most widely used ores. This ore also has high acoustical value after expansion, as it lends itself to the production of minus 14 plus 30-mesh expanded material desired by the acoustical industry).

Furnacing

Various types of furnaces are now in use for the intumesence of perlite ores. They vary in design from vertical, inclined and horizontal stationary to inclined rotaries. Both direct and indirect heat applications are in use, and in most installations some type of pre-heat is employed, either from a separate pre-heater or from a pre-heat zone in the furnace itself. Co-current or counter-current ore feeds are used. In addition to the furnace units mentioned, several types of vibratory furnaces present interesting possibilities.

The three furnaces currently in use at our operations are of the co-current rotary type. In our larger furnace plant (capacity 1,600 cu.ft. of expanded material per 8-hr. shift), air classification is used to separate various sizes for particular requirements. In the smaller furnaces (capacity 800 and 350 cu.ft., respectively), sizing is accomplished by air classification with cyclones. The following represent what we consider to be ideal sizing of expanded PerAleX for uses indicated:

Concrete Aggregate

Mesh	Percent
—4+16	about 45
—16+50	about 40
—50+pan	about 15

Hardwall Plaster Aggregate (Brown and Scratch Coats)

Mesh	Percent
+ 4	0
—4 + 8	0 to 10
—8 + 30	15 to 70
—30 + 50	15 to 55
—50+100	5 to 20
—100+ 0	0 to 10

Grading of each of the size groups should approach the maximum rather than the minimum of each size series.

Acoustical Plaster Aggregate

Mesh	Percent
+ 8	0
—8+14	0 to 10
—14+30	70 to 100
—30+50	0 to 20
—50+ 0	0 to 5

Finish coat plaster aggregate is achieved by utilization of the finer mesh expanded perlite usually produced in a secondary chamber or cyclone, and approximates a minus 16-mesh material.

Technology relative to heat treatment of particular perlite ore has shown that weights approaching 1 lb. per cu.ft. may be achieved on sized fractions. Research indicates that these popped particles are not single bubbles, but consist of many bubbles within each grain, being vacuum-sealed bubbles having a bubble shell thickness approaching 1/1,000,000 to 1/10,000,000 of an inch in thickness. While we have only produced this unusual weight material in the laboratory, our research points definitely to volume expansion and utilization of this type of material where super-insulation is required. In general, the weights of material used in the industry run from 7 to 15 lb. per cu.ft., and "K" factors are approximately similar to other granular lightweight materials on this weight range. Perlite's non-hydroscopic quality (our perlite absorbs less than 0.2% of moisture from the air at 100% relative humidity at temperatures from 85 to 90 deg. F.) assures one of a constant heat resistance factor without deterioration when used as an insulator.

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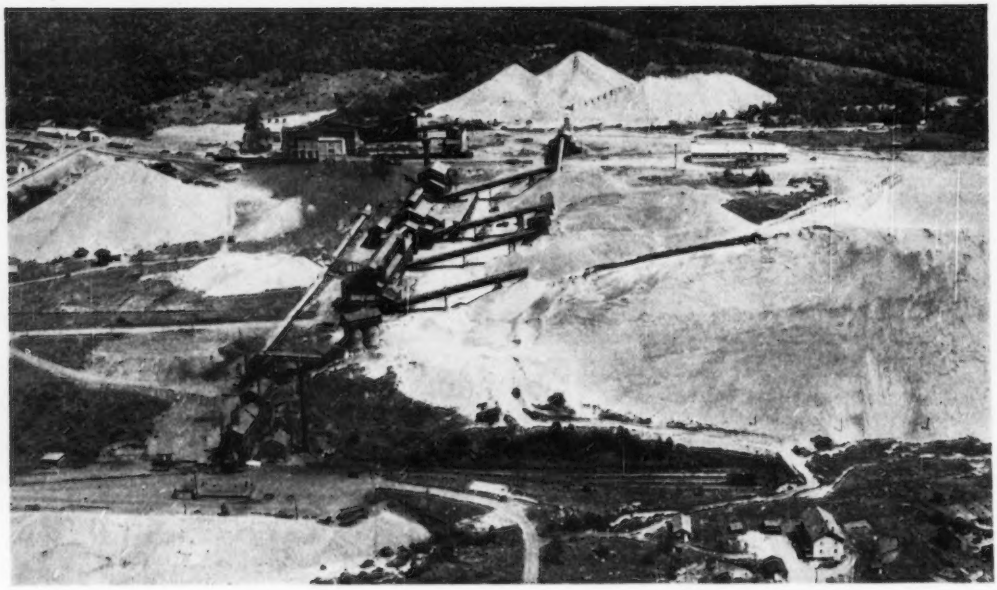


ADIRONDACK UNDERGROUND ORES can be beneficiated for shipment by simple treatment, here at Lyon Mountain.

"Adirondack iron ore field still offers

Republic Steel's former vice president, now the Corporation's mining consultant, says this region holds immense tonnages of ores, now submarginal, but waiting the development of better operating methods and lower costs—this in addition to the very substantial reserves that can be mined today.

ALMOST 40 YEARS AGO I made my first trip into the Adirondack area to investigate the possibilities of Northern New York as a source of iron ore. Though the investigation was by no means complete, it was still sufficiently thorough to convince me that there were great possibilities that the steel industry as a whole was overlooking.

I returned from my trip, reported to my associates, and was laughed at for my pains. Why should anyone, they asked me, go up into the wilderness of Northern New York State to get iron ore when there was an inexhaustible supply in the Lake Superior region? Why should anyone sink shafts 1,000, 2,000, 2,500 ft. deep to secure iron ore when it could be scooped up with shovels on the Mesabi? Why should anyone ship ore by rail from northern New York State when it could be brought by water from Duluth and Superior?

From an address made at the annual meeting of the Mineral Engineering Division of American Society for Engineering Education at Rensselaer Polytechnic Institute, Troy, N. Y., June 20, 1949.

Hard to Convince

It was pretty hard to give convincing answers to such questions. The steel industry was hypnotized, as it were, with the seemingly endless possibilities of the Lake Superior region. No one ever stopped to realize in those early days—or, as a matter of fact, for many, many years later—that any iron ore deposit has a bottom—that eventually, if you take out enough of the ore, the bottom of the deposit is reached.

As a matter of fact, it is only within the last few years that we have begun seriously to consider the exhaustion of our great open-pit mines and their rich shipping ores. Half a century ago when ore deposits were seemingly inexhaustible, steel men had no need to be ore-minded.

So the Adirondacks offered little but a tantalizing subject for speculation for a quarter of a century. I never gave up the idea that the ore deposits in that region could be mined and used in our Lake area steel plants profitably.

Republic Receptive, Others Follow

Then in the middle 30's the Corrigan, McKinney Steel Co., of which I was president, became a part of Republic, so I started all over again and this time to a more receptive audience, for Republic was not overly blessed with ore reserves in the Lake region. In the late 30's we acquired by lease two Adirondack iron mining properties—at Mineville and at Lyon Mountain. We now own both mines and are glad we have them.

If you were to read the history of northern New York State you would find that iron mines in this

REPUBLIC'S "81" OREBODY at Lyon Mountain, here mined on outcrop, has only recently been proved workable.

many challenges"— DONALD B. GILLIES

vicinity were among the early iron producers of this country. But even before the Revolution, in the middle of the 18th century, deposits of local limonite ores were being worked. In 1751 a furnace was built which later played its part in supplying the needs of the Colonies during the Revolution.

Working of Adirondack magnetites began in 1800. Small forges began to dot the Champlain Valley a year or two later. The activity grew steadily and from 1860 to 1890 New York State played an important part in the iron trade of the United States. In 1880 a million and a quarter long tons of ore was mined. As mining in the Lake Superior region boomed, the annual tonnage from the Adirondacks entered a period of gradual decline, but even in 1918 New York State still produced about 900,000 tons of ore.

As the plants on the lakes grew, the activity in New York State went down. And so far several decades the Adirondacks remained well in the background as a source of iron ore.

Following Republic's renewed interest in the region, three other companies began operating and have continued doing so. Our own operations have expanded until today we are producing almost 1,500,000 tons of finished product per year.

Geological Questions

Let us look at some of the geology of the area. For more than a century the nature, origin and geological occurrence of the Adirondack iron deposits have been subjects of discussion and dispute among geologists and students of mining. While the ores have features in common with those of Sweden, Brazil, and West Africa, they have some characteristics that are unique. Even today eminent scientists disagree on the basic nature and history of the rocks throughout the mining areas. While some hold the rocks to be truly igneous and to have cooled and crystallized from a molten state, studies of the mineral deposits lead most mining geologists to believe otherwise.

The mining investigations suggest that the rocks in the 10,000-sq.mi. Adirondack area were largely sediments deposited in ancient seas. Along with the limestone, shale, and sandstone that made up the bulk of these original rocks, two layers of iron formation were deposited. These strata were probably quite similar to the extensive low-grade iron formation of the Lake Superior region. The Lake Superior area, however, was not subjected to the geological beating that the Adirondack rocks suffered, and the Lake ores formed at selected spots in the iron formations through comparatively tranquil changes.

Early in geologic time the original rocks in the Adirondacks were buried by other rocks to a depth of five or more miles. At these depths the sediments became semi-fluid and were subjected to igneous influences. In one part of the rock mass, fluid magma intruded and assimilated the sediments to form the crystalline, resistant rocks which now stand out as the higher mountains like Whiteface and Mount Marcy in the vicinity of Lake Placid. Most of the rocks surrounding today's higher mountains, however, never actually melted, and they retain to this day vestiges of their original stratified, sedimentary character.

The deep burial and near igneous

conditions brought about many changes in the ancient sediments. The chemical constituents reassembled to form new rock minerals and the beds were twisted and flowed in grotesque convolutions and folds. The layers of iron formation were transformed, and the iron itself converted from an impure carbonate to the magnetic oxide. In places, the iron migrated along the bedding planes to zones of slightly less pressure and greater permeability, such as the crests and troughs of folds. This migration of the iron and its concentration in these limited spaces formed the orebodies which we mine today. Major mountain uplifts and countless centuries of erosion ultimately brought these deposits to the surface within the reach of mining.

Folds Govern Orebodies

It is significant, both in the search for new orebodies and in directing mining to maximum advantages, that all the operating iron mines—at Clifton, at Benson Mines, at Lyon Mountain, and at Mineville, and even the kindred titanium ores at Tahawus—are closely associated with folded rocks. The attitude and direction of the folds govern the direction and inclination of the orebodies.

Owing to their deep origin, the deposits exhibit little change throughout vertical ranges of thousands of feet and are among the most persistent ores known to the mining world. Although the detailed pattern of folding and crumpling may change as we go downward from level to level in a mine, the amount of iron and grade of ore is remarkably uniform.

The chemical realignment of the iron during the ore-forming period and the prolonged deposition that developed relatively large crystals of magnetite was a particularly happy coincidence. These factors make it practical to concentrate ores that are too poor in iron for direct furnacing. When crushed and ground to particle sizes no smaller than one-twentieth of an inch in diameter, the great bulk of these ores give up their iron in magnetic separators. This concentrate in turn is sintered to produce a highly desirable furnace feed of exceptional purity.

To multiply the output of the Adirondacks, a wide range of engineering talent has been enlisted. Indeed, not a day passes at any of the New York iron mines that lacks its quota of engineering problems.

The mining of orebodies which are found in such complexly folded shapes calls for continual careful planning of the master mining layouts as the ore extraction progresses. As we go deeper in the ground, no mine level is an exact replica of a shallower one. As the pattern of folding changes in varying degrees as the ore is followed downward into the earth, each level in the mine must be planned for the most economical removal of the ore that is tributary to it. This calls not only for keen appreciation of the three-dimensional geometry of the orebodies, but also for sound engineering judgment of the strength of the ore and of the surrounding rocks. To meet these problems, microseismic measurements have been made to test the competence of ore pillars which are left in the ground to support the roof. Likewise, laboratory tests have been made to test both the crushing and tensile strengths of the roof rocks and the ore. Finally, mining judgment based on experience and guided by the test data determines the distribution and the size of chambers that can be safely opened up.

By far the greater part of the iron now coming from the Adirondacks is obtained through underground mining. At Benson Mines a happy combination of rock structures and topography permits the less costly open-pit method.

Recently our company has also started an open pit at the "81" mine near Lyon Mountain. The "81" mine is on a folded portion of the Lyon Mountain ore formation that has only recently been explored on an extensive scale. Although a few thousand tons was mined from this deposit in the past century, it was not until magnetic surveys were made and diamond drilling undertaken within the past three years that the size and workability of this deposit were fully appreciated. We plan to recover ore from the "81" mine by open-pit methods until this is no longer practical. Thereafter the deeper extension of this orebody will be removed by conventional underground mining.

Role of Transport

Engineering is not limited to the mining alone, for transportation in its various forms plays a major role in the extraction and treatment of the Adirondack ores. Haulage underground is by both trolley and battery locomotives. Then the ore and rock must be hoisted to the surface. Next, conveyors move the ore from place to place throughout the crushing plants and mills. At Mineville the ore is gathered after primary crushing at the separate sources and hauled to the central mill by standard-gage railroad. Modernizing this railroad included the adoption of diesel locomotives. The bottleneck on this railroad has not been the tonnage of ore that could be hauled from the mines, but rather the number of empty cars that could be hauled back up the steep grades to the west of Lake Champlain. In years gone by, our steam equipment could handle only 10 to 12 cars. Today the diesels haul trains of 18 to 20 cars. Thus in a back-handed manner the internal combustion engineers have greatly increased the capacity of our railroad.

Milling Has Its Problems

To the engineer who specializes in ore dressing, the milling plants of the Adirondacks may appear relatively simple. Wet magnetic concentration is now the general practice throughout the district. As with other milling methods, the process follows the basic principle of removing as much of the metallic concentrate as possible at the earliest stage of crushing and grinding. Simple as this may sound, the ore at each deposit has individual characteristics and a lot of experimentation was a necessary prelude to the present smooth-running operation.

Some Ore Not Magnetic

At a few of the Adirondack deposits, particularly the Benson Mines, a part of the iron in the ore occurs in the non-magnetic form, hematite. Formerly this was discarded, but within the past year the Jones & Laughlin company have added facilities for gravity separation to their mill, and today they achieve a more complete recovery of the iron in the ore than would be possible with magnetic separators alone. In the years to come, it is highly probable that gravity methods will supplement magnetic concentrators at one or more other New York mills.

The handiwork of the electrical engineer is everywhere apparent throughout the mines and mills. Electric motors power the pumps that keep the mines dry, the fans that supply fresh air for the miners, the scrapers that drag the freshly broken ore from mining faces, the underground haulage locomotives, the mammoth hoists lifting the ore

to the surface, the air compressors that feed the pneumatic drills, the rock crushers, belt conveyors, grinding mills, vibrating screens, hydraulic classifiers, and on through the sintering plant—electric motors everywhere. And unseen by the casual observer of turning wheels is the detailed engineering planning that integrates the diversified and fluctuating loads. This keeps peak demands at reasonable levels and brings good power factors to focal points of power application.

Submarginal Ores Also

The success of the Twentieth Century iron mining in the Adirondacks has been a triumph of engineering. Yet the field still offers many challenges. In addition to the substantial reserves of ore that can be mined today, immense tonnages of iron ore are known to exist in ores that are somewhat submarginal in the present economy and with present operating methods. To make these ores economically usable offers a challenge to develop new and more efficient mining techniques, more rapid and less costly modes of ore transportation, and improved methods of separating the iron minerals from the gangue rock in mills yet to be designed. With reference to the milling, I would emphasize that the ores of the Adirondacks require far less grinding than do the taconites of the Lake Superior region, and sintering of the metallic concentrates has been accomplished more readily than preparing the taconite concentrates for the blast furnace. While we have already accomplished what looks like a great deal, the low-grade ores offer a chance to apply many advances in a wide variety of engineering fields.

Titanium Also Challenges

Another challenge is found in our titaniferous iron ores. To be considered as a source of titanium, an ore today must contain about 20% TiO_2. On the other hand, for an ore to be an acceptable source of iron, the blast-furnace charge should not contain more than 1% TiO_2. The Adirondacks have a number of deposits which analyze about 8% titanium oxide. This is neither an ore of titanium nor an ore of iron. Milling experts and metallurgists may some day find a way of separating the minerals in the ore so that both the valuable metals may be utilized.

Finally, proud as we are of recent successes in mining and treating the somewhat richer and more favorably situated ores that are worked today, there is, like in every other engineering enterprise, ample room for improvement. The operators may boast of what has been done, but we are humble when we contemplate the engineering advances that the future will bring.

Still Another Look

The Adirondacks have many advantages which have been largely overlooked. Let me make it clear at this point that I am under no illusions about the Adirondacks. I do not believe they will ever take the place of the Mesabi or the important sources of the Lake Superior area, but I am convinced that for many, many years to come we will secure a substantial tonnage of a high-grade product from this region.

During the ten years 1918 to 1928, the Adirondacks produced 0.6% of the total iron ore mined in the United States. In 1948 this had increased to 2.86%.

I am equally convinced that when the final figures are in, we will be surprised at the tonnage of this rich fundamental mineral which is available for our steel industry.

Critics of the Adirondack ores have pointed out the necessity of beneficiating much of the raw product. Up to a few years ago beneficiation was a relatively unknown process. Today the requirement for beneficiation does not loom as nearly as serious a matter in the minds of the steel makers. We know that there are billions of tons of taconite ores in the Lake Superior region which will require beneficiation before they can be used in our furnaces.

While beneficiation of necessity increases the per-ton cost of a finished product, we have made up our minds to accept that additional expense as the price which we must pay to keep our steel industry at a high peak of operation and thereby maintain the living standard to which this country is accustomed.

Though beneficiation does mean an added price per ton of shipping product, there are advantages which we cannot overlook. We are getting a product with a much higher iron content. We are eliminating moisture which ranges up to 12% in our free shipping areas. We are securing a uniformity which can be followed straight through the steelmaking process. The high iron content increases blast-furnace capacity, decreases coke consumption and makes for a furnace operation that runs more smoothly than would otherwise be the case.

Our experience has shown that Adirondack sinter can be used to great advantage as charge ore in the open hearth. Our tests have shown that it is superior for this purpose to the Lake Superior soft ores. High-iron charges of 55% or more are substantially aided by the use of this material which results in increased tonnage of steel ingots per furnace-hour, decreased fuel consumption and, in addition, greater safety to the open-hearth workmen.

An electromagnet can be employed to load charging boxes because of the magnetic properties that the sinter possesses, and the moisture content is so low that freezing in winter time is reduced to an absolute minimum.

For more than a decade a large amount of this sinter has also been used by Republic in its blast furnaces. We have found that an increase of sinter in the blast-furnace burden to 40 to 45% of the metallic charge will raise production from 10 to 19%, decrease coke consumption by approximately 15%, lower the flux consumption by about one-fifth, and cut flue-dust production by as much as 50%.

In the case of the Adirondacks, where substantially all of the mines are underground, we have the advantage of year-round operation and the elimination of costly stockpiles.

It is not possible to place a dollar-and-cents value on all these factors but they are of sufficient importance to outweigh some of the added expense which naturally follows this type of mining in this particular area.

An Ample Source of Ore

To review in a few sentences, the Adirondack region has been proven to be a source, and an ample source, of iron ore. Experience has shown that this ore, either in its native state or when beneficiated, becomes a highly useful product to the steel industry.

The advantages of the Adirondack ores are such that they can be regarded as competitive with the Lake Superior ores.

I have every reason to believe that the development of these ores in northern New York State will continue at an accelerated rate to the advantage of the American steel industry.

Tariff Rates, History and Negotiable Ranges

THE TABLE HEREWITH gives the principal mineral tariffs at a glance, as well as when they were established and what ranges are possible for future negotiations.

Except for lead and zinc, the rates prevailing in 1945 are the basis for the range of future negotiations. A maximum of 50% above and a minimum of 50% below these levels is permitted, at the President's discretion, given appropriate findings of fact. The lead and zinc negotiable ranges are based on the "permanent" (post-emergency) rates established in the Mexican agreement. If this agreement is denounced as presently expected, lead, fluorspar and molybdenum ore will revert to the Act of 1930 rate, but the negotiable ranges will be unchanged. Zinc, having been bound at Geneva, will not be affected. On the other hand, lead, fluorspar and molybdenum rates may possibly be bound at Torquay this fall before the Mexican agreement lapses.

The Mexican, Paraguayan, Geneva and Annecy agreements contain "escape" clauses permitting the cancellation of rates on single commodities if a suitable finding of fact is made that the new rates are seriously injurious to established domestic industries. However, experience has demonstrated that the Government is loath to utilize the escape clauses. Thus, a domestic industry seeking action under escape clauses is well advised to defer its application for relief until genuine distress from added imports due to reduced duties is incontrovertible.

The last general tariff law was the Act of 1930 (Smoot-Hawley tariff). The Reciprocal Trade Act, originated in 1934 and renewed at intervals since, permits the Administration to raise or lower pre-existing rates 50% in making "reciprocal" trades with other nations. A new base for flexing was provided as of Jan. 1, 1946.

In 1947 the practice of making bilateral agreements was abandoned in favor of "round table" negotiations involving several nations. The first of these was at Geneva 1947, the second at Annecy, 1949, and a third will be held at Torquay, England, in Sept., 1950.

MINERAL	PRESENT DUTY	HOW LAST ESTAB.	WHEN DONE	1945 RATE	NEGOTIABLE RANGE	ACT OF 1930 RATE
Aluminum, crude						
Scrap	1½c. lb.	Geneva	1948	3c. lb.	1½c.-4½c.	4c. lb.
Other	2c. lb.	Geneva	1948	3c. lb.	1½c.-4½c.	4c. lb.
Antimony						
Regulus or metal	1c. lb.	Geneva	1948	2c. lb.	1c.-3c.	2c. lb.
Needle or Liquated	⅛c. lb.	Geneva[1]	1948	¼c. lb.	⅛c.-⅜c.	⅛c. lb.
Antimony ore	Free	Mexico[1]	1943	Free		Free
Asbestos, unmanuf.	Free			Free		Free
Barite, crude						
Product of Cuba	$3.20 ton	Geneva[1]	1948	$3.20 ton	$1.60-$4.80	$3.20 ton
Other than product of Cuba	$3.50 ton	Geneva[1]	1948	$4.00 ton	$2.00-$6.00	$4.00 ton
Barite, ground or otherwise manuf.	$7.50 ton	Geneva[1]	1948	$7.50 ton	$3.75-$11.25	$7.50 ton
Bauxite, crude	50c. ton	Geneva	1948	$1.00 ton	.50-$1.50	$1.00 ton
Beryllium ore	Free			Free		Free
Bismuth	3¾% a.v.	Peru	1942	3¾%		7½% a.v.
Cadmium	3¾c. lb.	Geneva	1948	7½c. lb.	3¾c.-11¼c.	15c. lb.
China clay	$1.25 ton	Geneva	1948	$1.75 ton	87½c.-$2.62½	$2.50
Chromite	Free	Geneva[1]	1948	Free		Free
Cobalt	Free	Geneva[1]	1948	Free		Free
Columbite	Free			Free		Free
Copper, metal and in ore	2c.[2] lb.	Geneva	1948	4c. lb.	2c.-6c.	4c. lb.[3]
Feldspar, crude	20c. ton	Canada	1939	25c. ton	12½c.-37½c.	$1.00 ton
Fluorspar (containing more than 97 per centum of calcium fluoride)	$4.20 ton	Mexico	1943	$4.20 ton	$2.10-$6.30	$5.60 ton
(Containing not more than 97 per centum of calcium fluoride)	$6.30 ton	Mexico	1943	$6.30 ton	$3.15-$9.45	$8.40 ton
Fullers Earth						
Unwrought and unmanufactured	50c. ton	Geneva	1948	$1.00 ton	.50-$1.50	$1.50 ton
Wrought or manufactured	$1.00 ton	Geneva	1948	$2.00 ton	$1.00-$3.00	$3.25 ton
Iron ore	Free	Iran	1944	Free		Free
Lead	1 1/10c. lb.[4]	Mexico	1943	1 1/16c. lb.	0.85c.-2.55c. lb.	2¼c. lb.
Lead in ore	¼c. lb.[5]	Mexico	1943	¾c. lb.	0.6c.-1.8c. lb.	1½c. lb.
Magnesium	20c. lb.	Geneva	1948	40c. lb.	20c.-60c.	40c. lb.
Magnesite						
Crude	15/64c. lb.	Geneva	1948	15/32c. lb.	15/64c.-45/64c.	15/32c. lb.
Manganese in ore Ferruginous						
Containing over 10 but less than 35% manganese	¼c. lb.	Geneva	1948	½c. lb.	¼c.-¾c.	1c. lb.
Ferro & chemical grades						
Containing 35% or more manganese						
Product of Cuba	Free	Geneva[1]	1948	Free		Free
Other than product of Cuba	¼c. lb.		1948	½c. lb.	¼c.-¾c.	1c. lb.
Mica, unmanuf.						
Valued at not above 15c per lb.	4c. lb.	Argentina	1941	4c. lb.	2c.-6c.	4c. lb.
Value above 15c per lb.	2c. plus 15% a.v.	Annecy	1950	4c. lb. plus 25%	2c.-6c. plus 12½ to 37½%	4c. lb. plus 25% a.v.
Films & Splittings						
Below .0012 in.	12½%	Annecy	1950	25%	12½-37½%	25%
Above .0012 in.	20%	Annecy	1950	40%	20-60%	40%
Mica, ground or pulverized	15% a.v.	Geneva	1948	15% a.v.	7½-22½%	20% a.v.
Molybdenum in ore	1½c. lb.	Mexico	1943	17½c. lb.	8.75c. to 26.25c. lb.	35c. lb.
Nickel and nickel in alloy	1¼c. lb.	Geneva	1948	2½c. lb.	1¼c.-3¾c.	3c. lb.
Ochers, crude	⅛c. lb.		1930	⅛c. lb.		⅛c. lb.
Washed or ground	⅛c. lb.	Geneva	1948	¼c. lb.	⅛c.-⅜c.	⅜c. lb.
Platinum, unmanuf.	Free	U.K.[1]	1939	Free		Free
Pyrites	Free	U.K.[1]	1939	Free		Free
Quicksilver	25c. lb.		1930	25c. lb.	12½c.-37½c.	25c. lb.
Sulphur	Free	U.K.[1]	1939	Free		Free
Talc, crude	⅛c. lb.	Geneva	1948	¼c. lb.	⅛c.-⅜c. lb.	¼c. lb.
Powdered, or pulverized						
Valued at not more than $14.00 per ton.	10% a.v.	Geneva	1948	17½%	8¾-26¼%	35% a.v.
Valued at more than $14.00 per ton	35% a.v.		1930	35%	17½-52½%	35% a.v.
Tantalite	Free			Free		Free
Titanium ore	Free			Free		Free
Tungsten in ore	38c. lb.	Geneva	1948	50c. lb.	25c.-75c.	50c. lb.
Tripoli	Free	Mexico[1]	1943	Free		Free
Vanadium ore	Free	Peru[1]	1942	Free		Free
Zinc	⅞c. lb.	Geneva[1]	1948	⅞c. lb.	0.7c.-2.1c. lb.	1¾c. lb.
Zinc in ore	¾c. lb.	Geneva[1]	1948	¾c. lb.	0.6c.-1.8c. lb.	1½c. lb.

[1]Bound. . . [2]Waived by Public Law 42, expiring June 30, 1950. . . [3]Excise tax, Revenue Act of 1932. . . [4]Rises to 1.7 cents per lb. at end of unlimited national emergency. . . [5]Rises to 1.2c per lb. at end unlimited national emergency.

MARKETS—Trends and Prices (*Continued from page* 53)

Summary of Copper Statistics

Following is a summary of the copper statistics reported by members of the Copper Institute, figures in tons:

UNITED STATES

Production:	Nov.	Dec.	Jan.	Feb.	(a) March	April
Crude, primary	67,479	71,864	73,625	69,994	78,928	74,262
Crude, secondary	13,119	8,526	12,001	10,762	11,407	9,924
Totals	80,598	80,390	85,626	80,756	90,335	84,186
Refined	92,602	94,947	95,229	94,036	113,440	103,293
Deliveries, refined	117,133	107,662	111,668	112,773	123,030	101,729
Stock at end, refined	139,199	116,027	101,070	77,472	60,276	57,028

OUTSIDE UNITED STATES

Production:	Nov.	Dec.	Jan.	Feb.	(a) March	April
Crude, primary	104,822	97,156	106,162	110,089	108,159	104,556
Crude, secondary	1,036	975	1,669	549	1,227	1,008
Totals	105,858	98,131	107,831	110,638	109,386	105,564
Refined	84,571	83,261	87,923	83,501	84,604	89,369
Deliveries, refined	78,898	77,604	81,574	69,193	72,626	72,047
Stock at end, refined	148,161	147,972	142,971	144,893	148,455	150,444

(a) Corrected figures.

Official London Prices

The British Ministry of Supply continues to fix delivered prices of copper, lead and zinc for the United Kingdom. Quotations in effect as May ended were as follows:

	Per Long Ton £ s. d.
COPPER:	
Electrolytic, high conductivity	170 0 0
Fire refined, high conductivity	170 0 0
Fire refined, high grade	169 10 0
Fire refined, min. 99.7 percent	169 0 0
Fire refined, min. 99.2 percent	168 10 0
LEAD:	
Soft, foreign duty paid	96 0 0
Soft, Empire	96 0 0
English, refined	97 10 0
ZINC:	
Foreign (G.o.b.) duty paid	107 10 0
Domestic (G.o.b.) duty paid	107 10 0
Prime Western and debased	107 10 0
Refined and electrolytic	108 5 0
Minimum 99.99 percent	109 15 0

Miscellaneous Metals, Ores, Minerals

Quotations cover wholesale lots, prompt shipment, f.o.b. New York unless otherwise stated

MISCELLANEOUS METALS

(May 31, 1950)

Aluminum, ingot, 99 plus percent, lb. (base price)	17¼c.
Antimony, spot, lb., 5 tons and up but less than carload in cases	27.78¢
Bismuth, ton lots, lb.	$2.00
Cadmium, commercial sticks, delivered, lb.	$2.00
Calcium, 1 lb., ton lots, 98 percent, cast	$2.05
Chromium, 97 percent grade, lb., contract	$1.07
Cobalt, 97 to 99 percent, per lb.	$1.80
Indium, troy oz.	$2.25
Nickel, cathodes, lb., f.o.b. Port Colborne (a)	40c.
Magnesium, 99.8 per cent, carloads, lb., producer's plant	20½c.
Palladium, troy oz.	$24.00
Platinum (Official quotation wholesale lots) troy oz.	$66.00
Quicksilver, flask of 76 lbs., 25 flasks or more	$70.00
Selenium, 99.5 percent, lb.	$2.00
Silicon, minimum 97 percent, spot, carloads, lb.	16.50c.
Tellurium, lb.	$1.75 nom.
Thallium, 100 lb. or more, lb.	$12.50
Titanium, 96 to 98 percent, lb.	$8.00

(a) Includes U. S. duty

METALLIC ORES

Beryllium Ore, imported, 10 to 12% BeO, per unit	$26.00
Chrome Ore, per long ton, f.o.b. cars Atl. ports, dry 45% Cr_2O_3, no ratio	$17.30@$18.30
48% Cr_2O_3, 3 to 1 ratio	$35.00@$38.00
Iron Ore, Lake Superior, Lower Lake ports, long ton:	
Old Range bessemer	$8.10
Mesabi bessemer	$7.85
Old Range non-bessemer	$7.95
Mesabi, non-bessemer	$7.70
Lead (Galena), 80 percent, Joplin, Mo., ton	$147.67
Manganese Ore—Per long ton unit of Mn basis 48 percent manganese, nearby positions, subject to premiums and penalties, 74 @ 76c., c.i.f. U. S. ports, duty extra. Long-term contract prices nominal.	
Molybdenum Ore, 90%, per lb. of MoS_2 f.o.b. mines	54c.
Tantalite, 60% concentrate, per lb.	$2.00@$2.75
Tungsten Ore, per unit of WO_3	
Foreign, 60 percent, duty paid	$19.50@$20.00
Domestic, scheelite, 60 percent and upward	$28.50
Vanadium Ore, per lb. of contained V_2O_5 f.o.b. mines	27½c.
Zinc Ore, Prime, 60 percent concentrate, Joplin, Mo. per ton	$82.50

METALLIC COMPOUNDS

Arsenious Oxide (arsenic trioxide) lb., in bbl. carload lots delivered	5½c.
Cobalt Oxide, 72%, metallurgical grade, per lb. of Co	$1.95
Copper Sulphate, 100 lb.	$7.60

ALLOYS

Beryllium Copper, 4 percent Be, per lb. of contained Be	$24.50
Ferrochrome, 65 to 69 percent, per lb. of Cr contained	20.50c.
Ferromanganese, 78 to 82 percent, gross ton, seaboard	$172.00
Ferromolybdenum, 55 to 65 percent Mo, lb. of Mo, contained	$1.13
Ferrosilicon, 50 percent, per lb. of contained Si	11.3c.
Ferrotungsten, 75 to 80 percent, lb. of W contained	$2.25
Ferrovanadium, per lb. of V delivered	$2.80
Silicomanganese, 1½ percent C, per lb. contracts	9.95c.
Spiegeleisen, per long ton, 19@21%	$66.00

NON-METALLIC MINERALS

Asbestos, f.o.b. Canada (Quebec) mines (U. S. funds), ton:	
Crude No. 1	$960@$1,050
Crude No. 2	$492@$550
Spinning fibers	$232@$475
Shingle fibers	$95.50@$141
Paper stock	$78.50@$88
Waste	$58
Shorts	$27@$52
Vermont, f.o.b. Hyde Park:	
Shingle stock	$97.00@$107.00
Paper stock	$68.50@$85.00
Waste	$51.00
Refuse or shorts	$25.50@$46.50
Barytes, f.o.b. mines:	
Georgia, crude, per long ton	$11.50@$12.00
Missouri, 93 to 94 percent $BaSO_4$, per short ton	$9.00@$9.50
Bauxite, long ton, f.o.b. point of shipment:	
Domestic, crude, 50 to 52 percent (not dried)	$4.00@$5.10
Domestic, chemical, 55 to 58 percent	(a)$8.50@$9.50
Domestic, abrasive, 80 to 84 percent	$13.00@$13.50
China Clay, f.o.b. mines, ton:	
South Carolina and Georgia, No. 1, airfloated bulk	$8.50@$9.50
North Carolina ceramic grade	$18.00@$20.00
Feldspar, bulk ton:	
Potash or soda feldspar, 200 mesh	$18.50
Glass spar, white, 20 mesh	$11.75@$12.50
Fluorspar, f.o.b. mines, bulk, Kentucky and Illinois, 70% effective, CaF_2, ton	$37.00
Acid 97% concentrate, bulk, ton	$43.50
Fuller's earth, f.o.b. Georgia or Florida, ton	$7.00@$14.00
Magnesite, per ton dead-burned, bulk, f.o.b. Washington	$30.50
Mica—Domestic f.o.b. mines, Punch, 12 to 22c. per lb. according to size and quality. Sheet, clear, 1½ x 2 inch, 70 to 75c.; 2 x 3 inch, $1.10 to $1.70; 2 x 3 inch, $1.40@$1.50; 3 x 3 inch, $1.70@$1.80; 3 x 4 inch, $2.10; 3 x 6 inch, $2.40; 4 x 6 inch, $3.15; 6 x 8 inch, $4.25. Wet ground, very fine, $120 @ $130 per ton. Bulk sales, dry ground, $32.50@$60.00 per ton. Scrap, $30 and up.	
Ocher, Georgia, ton, in sacks	$24.00
Pyrites, Spanish, per long ton unit of S, c.i.f. Atlantic ports	(a)13@14c.
Sulphur, Texas, mines, long ton	$18.00
Talc, f.o.b. works, ton:	
New York, purified	$18.50@$20.00
Vermont, extra white	$12.50
Tripoli, Missouri, ton:	
40 mesh, cream colored	$14.50

(a) Nominal

IRON AND STEEL

Pig iron, gross ton, basic, Valley furnaces	$46.00
Steel, f.o.b., Pittsburgh billets, net ton	$53.00
Structural shapes, 100 lb.	$3.40

WASHINGTON REFLECTIONS

Seabrook Hull, McGraw-Hill Washington News Bureau

Revamped Mine Incentive Payments Bill Has Good Chance of Passage

AS WE GO TO PRESS, the chances seem better than at any time since the surprise defeat of S. 2105 that this Congress will push through an incentive payments bill for mining. At most, however, anything done this year will probably be little more than a foot-in-the-door aid to the mining industry.

Administration sentiment towards some kind of an aid to mining has softened somewhat in the past few weeks, though there are still no signs of open support. However, Congressional leaders have suggested since S. 2105's defeat that maybe if mining Congressmen would make another try to get an incentive payments bill through they might have better luck. It's more encouragement than they got for S. 2105.

Result was a flurry of incentive payments bills in the House and one in the Senate. As it boils down now, on the House side the race is between Rep. Clair Engle's H.R. 8221 and Rep. Sabath's H.R. 8668. The bills are identical except for the amount of money involved. Engle's bill calls for $330 million in four years while Sabath's bill cuts that figure in half —$30 million for the first year and $45 million each year thereafter.

In the Senate, Sen. Malone introduced S. 3570 which matches Engle's bill all the way through, including the amount of money involved.

In what they are designed to do these bills vary little from S. 2105. The bills now being considered eliminate the board that would have controlled administration of the program under S. 2105 and throw the whole responsibility into the hands of Interior Secretary Chapman, making the status of other departments advisory. Difference here is minor, as Chapman would have been chairman of the proposed board anyway.

One other difference is a modification of the automatic eligibility clause for small-mine applicants. Now it reads ". . . if it is determined upon examination there is a reasonable promise of developing unknown or undeveloped sources of metals or minerals." In S. 2105 it read ". . . if the application discloses there is a reasonable . . .," etc.

Under the present proposals it would depend entirely on the administrative interpretation of the bill how "automatic" approval of small mine applications would be.

Whether or not it's getting too late to push a bill through—assuming the votes are there both on the House and Senate floors—depends to a large extent on the parliamentary mechanics involved.

Engle's bill, which was introduced April 26, was referred to the House Committee on Public Lands, which promptly reported it out. It was then referred to the Rules Committee, which had to give it a rule before it could be considered for passage on the House floor. Sabath of the Rules Committee refused to give the bill a rule, declaring that it provided too much money.

Sabath immediately introduced H. R. 8668, identical with Engle's bill except that the money was halved. This bill was sent to the House Committee on Public Lands, where it now awaits action. Meanwhile, Engle's bill is, temporarily at least, shelved in the Rules Committee.

Chances are that Public Lands will report favorably on the Sabath bill and that that will be the one to reach the House floor. This means the incentive payments bill most likely to get favorable action in the House would provide only $165 million, instead of the $330 million desired by mining Congressmen.

On the Senate side, there is now only one bill, Sen. Malone's S. 3570, which calls for $330 million. It's now in the Senate Committee on Interior and Insular affairs, where favorable action is expected. Its backers aren't worried about its chances of passing the Senate.

This means that the bills the Senate and House transmit to each other probably will be identical, except for the amount of money involved. This difference will have to be thrashed out in a conference committee of the two houses. The result could be approval of either figure or a compromise of any total in between.

If this measure passes, with either sum of money, a veto is not expected.

However, even if the bill passes all these hurdles before Congress packs up and goes home, it's only an authorization. It doesn't in itself provide money, but simply lays down the ground rules for spending money. An appropriation bill would have to be introduced and run the gauntlet of both Senate and House appropriations committees as well as floor debate in both cases. Appropriations committees commonly cut actual appropriations well below authorizations, in fact do it fairly often. It could happen in this case, or an appropriation might be passed over in this Congress.

Thus, if an incentives payments bill is to be pushed through and put into operation this year it's going to take all the support possible from proponents. Mining congressmen are doing their best, though some of them are starting to wonder just why. There is still a notable lack of letters and telegrams in support of the bill being received on Capitol Hill.

Assessment Work Bill Unlikely to Pass

REP. STOCKTON'S H. R. 8488, to continue the moratorium on mine assessment work for another year, isn't arousing much interest on Capitol Hill. Committees and Congressmen are getting more letters in support of it than they are in support of incentive payments, but few seem inclined to push the matter.

The bill is now holed up in the Public Lands Committee of the House. Unless the bill goes through, the present exemption expires June 30, 1950.

Enabling Legislation On Point Four Passed

THE POINT FOUR BILL to give U. S. technical assistance to the world's underdeveloped areas has been signed into law. However, don't look for the U. S. to launch immediately a program of large-scale world development. Projects take time to work up. Also, even if Congress appropriates the $35 million authorized in the bill, there will be only $15 million available for new projects. United Nations and existing U. S. programs will take $10 million each. Besides, State Department planners aren't sure yet just what to do with the $15 million they hope to get clear.

The measure (Title IV of H. R. 7797) simply authorizes technical assistance, not financing for projects themselves. This assistance may be given under the auspices of the United Nations, the Organization of American States, or in separate bilateral arrangements.

There is also pending, but not yet passed, a bill (H. R. 8083) to authorize the guarantee of convertibility into U. S. dollars of proceeds of "United States private capital invested in productive enterprises abroad which contribute to economic development in foreign countries"

(underdeveloped areas); also to guarantee such investments against "loss resulting from expropriation, confiscation or seizure by action of public authority." This language is not intended to include war risk. The Export-Import Bank is the administrative agency. A ceiling of $250,000,000 is imposed on the guarantee measure.

Brief, But Important

DUTY CUTS—Tariff cutters report a notable lack of complaints over the proposed list of items to be considered next fall at tariff-cutting talks scheduled in Torquay, England. The outcry over the much smaller list of two years ago was louder.

Actually, not more than a score of complaints have been registered over proposed non-ferrous metals listings, and these involve only zinc, chrome, lead, titanium and aluminum. A dozen complainants are scheduled to appear on proposals to negotiate tariff cuts on fluorspar, magnesite and diamonds, which just about rounds out the list. Time limit for applying to appear at hearings is now past.

COPPER TARIFF—Rep. J. T. Patterson's (R., Conn.) bill to continue the copper tariff exemption for another two years is still bottled up in the House Ways and Means Committee. Chances are it will be reported out favorably, as it has full and open Administration support. Whether or not it will get out in time to go to and through the Senate isn't known. Positive Administration pressure is anticipated.

DEPLETION — House Ways and Means Committee voted not only to refuse to lower present depletion allowances, but went a step in the other direction. New additions to the 15% depletion group are refractory clays, quartzite, metallurgical limestone, borax and fuller's earth. The committee also voted to extend the 15% allowance to two building materials, perlite and diatomaceous earth. Whether these additions will stand or not depends on what the Senate does.

SILVER PURCHASE REPEAL—Some mining Congressmen are confident they've licked Sen. Green's bill to repeal the Silver Purchase Act. Actually, they're probably right, but one thing is certain: If Green's measure is defeated, this will be the narrowest escape the silver bloc has experienced in a long time.

STOCKPILING — Stockpilers will probably get most of the money they asked for. The House only cut $6.4-million from requests, thus approving $633.6-million in cash and $100-million future-contract authorizations. The House, however, approved (unwittingly) an amendment to the stockpiling section of the omnibus appro-

(*Continued on p.* 142)

LABOR THIS MONTH

Joseph M. Gambatese
McGraw-Hill Washington News Bureau

WESTERN STEELWORKER LEADERS—Snapped at recent CIO Steelworkers' Atlantic City convention. Left to right: Varro C. Jones, International representative, Salt Lake City; Charles J. Smith, director, District 38, Los Angeles; M. J. Soldren, International representative, Pueblo, Colo.

TAFT-HARTLEY: Labor's chances of getting it repealed even by the next Congress grow dimmer. Instead of gaining, they are losing ground. The vote on the NLRB general counsel issue was a test ballot on Taft-Hartley, and Taft was able to round up four more votes than the necessary constitutional majority of 49.

NON-COMMUNIST AFFIDAVITS: Supreme Court's approval of non-Communist oaths by union leaders strengthened arguments against labor law repeal. It also put the Justice Dept. on the spot for doing nothing about 75 suspected perjured affidavits filed by left-wing union leaders, including Communists like Maurice Travis, Secretary-Treasurer of Mine, Mill and Smelter Workers. He "resigned" from the party just to sign the oath, but confessed no change in his Communist beliefs.

POTASH MINES: Mine, Mill's ability to stay in the potash mines at Carlsbad, N. M., after losing the 74-day strike last winter is being tested. Petitions aimed at ousting this left-wing union have been filed with NLRB by the three companies, the CIO Steel Workers, The International Associations of Machinists and the AFL Chemical Workers. Elections may take place this month.

CIO President Philip Murray's steel union is putting on the toughest drive. It's led by M. J. Soldren, husky USW-CIO representative stationed at Pueblo, Col.

The steel union's fight against Mine, Mill in the West was discussed at the union's Atlantic City convention last month (May) by the three men heading it up (see photo). They claimed big gains.

In the Midwest, the campaign is led by Nick Zonarick, who was president of the CIO Aluminum Workers before merger with the steel union.

The CIO has assigned to Murray's union the task of organizing the "Metal mines, mills, smelters and factories" over which Mine, Mill had jurisdiction before expulsion from CIO. The convention pledged all of the Union's "energies and resources" to the carrying out of this "mission."

Canadian delegates accused mining employers of aiding the Communists by refusing to sign contracts with the steel union after a Mine, Mill local switches affiliation.

Tip-Off: How the Steel Workers will try to force the steel industry's wage practices on metal mining was indicated by the Canadian delegates to the steel union's convention. They pointed out that wages under Mine, Mill contracts are 15 cents an hour below those in steel. The steel workers will insist, the delegates warned, that other companies "meet the higher wages prevailing in steel union contracts."

WAGE INFORMATION: In a series of decisions, NLRB has spelled out the wage data you must give a union if it asks for it:

A list of all employees covered by the union contract, indicating their department, payroll number, present wage, past wage and performance rating points.

This same information for at least a year prior to the beginning of negotiations.

"Full information" on merit wage increases, even though your contract may give you full discretion in granting such increases.

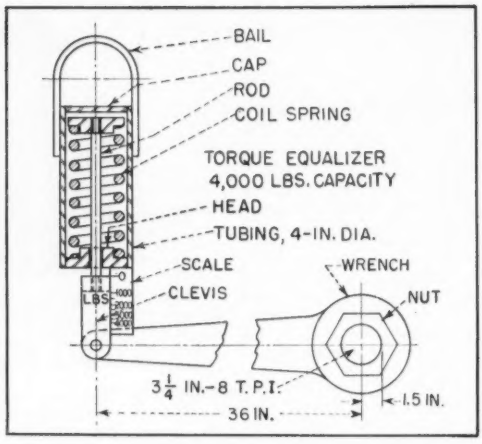
OPERATING IDEAS

Torque-Meter for Equalizing Tension on Bolts and Rods

The inexpensive shop-built torque-meter shown here was designed by Charles Begor, Jr., maintenance superintendent; John Zollinger, assistant maintenance superintendent; and Raymond Murdie, general shop-foreman of the maintenance department of National Lead Co., Tahawus, N. Y. It is used to measure the stress applied to large bolts, tie rods, and lock nuts on crushers and other heavy equipment. Equal distribution of tension increases the efficiency of each bolt and allows a greater amount of reserve tensile strength to be built up to take care of shock loads.

Construction of the torque-meter is shown in the accompanying drawing. Graduations on the scale are determined by attaching known weights to the clevis and marking corresponding values on the scale. The meter is used as follows: A crane or other means of hoisting is hooked over the bail. Then the wrench is placed over a nut and the torque-meter attached to the end of the wrench. Readings are taken with the wrench in a horizontal position, or with the centerline of the wrench at right angles to the meter axis.

"In checking up bolts previously tightened by guesswork," writes Mr. Begor, "we have found great differences in tension and, no doubt, the uneven stresses applied to bolts have caused overloaded bolts to snap. With the use of the meter, we have eliminated breakage. A formula for determining stresses for various diameters can be worked out."

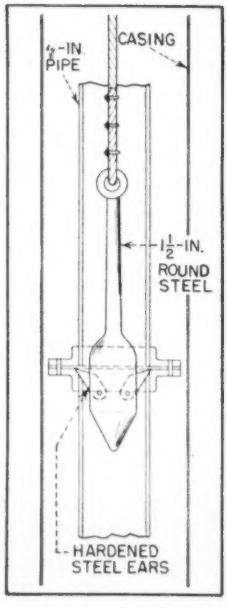


Fishing Tool Reclaims Pipe in Well

At a gold-silver mine in central Mexico several lengths of 4-in. pipe fell into a 250-ft. well with an 8-in. casing owing to failure of the chain hoist during lowering operations.

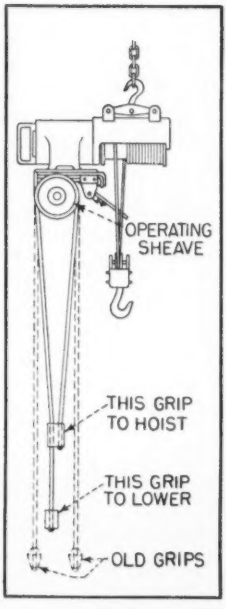
The pipe being lowered was part of the delivery pipe of an airlift system scheduled to be installed in the well.

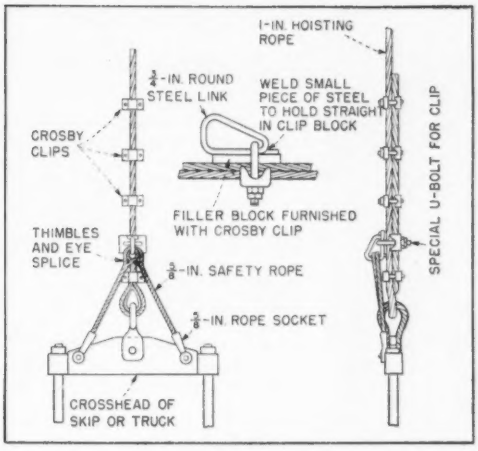
The pipe was reclaimed without difficulty with the simple tool shown. Attached to the end of a steel cable operated from a light tugger hoist, the tool was lowered into the well and fished around until it entered the pipe and dropped below a coupling. At this point the hardened ears dropped into the space between the ends of two pipes, thus locking the tool, and the pipe section was subsequently raised to the surface by slow operation of the hoist.



One-Handed Electric Hoist Control

Small electric hoists installed in mine repair shops, mills, and smelters generally are controlled by two hand ropes—namely, one for up and one for down direction, as in the accompanying sketch. To control the hoist rapidly in many instances requires two hands, and even under normal operation it is not convenient to shift from one control cable to the other when using only one hand to control the hoist. The problem can be solved as shown. One end of the control cable connects to the upper wooden grip, while the other end goes through the grip in a clearance hole and connects to the lower grip. After a load has been lowered, the hoisting grip can be brought into use quickly by moving the hand up to the hoisting grip.



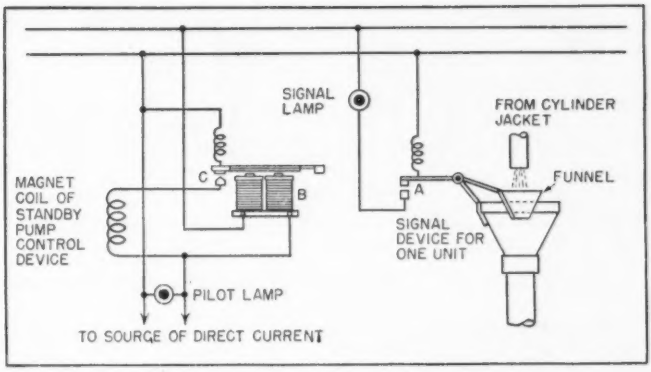

1-IN. HOISTING ROPE
⅞-IN. ROUND STEEL LINK
WELD SMALL PIECE OF STEEL TO HOLD STRAIGHT IN CLIP BLOCK
CROSBY CLIPS
FILLER BLOCK FURNISHED WITH CROSBY CLIP
THIMBLES AND EYE SPLICE
⅝-IN. SAFETY ROPE
⅝-IN. ROPE SOCKET
CROSSHEAD OF SKIP OR TRUCK
SPECIAL U-BOLT FOR CLIP

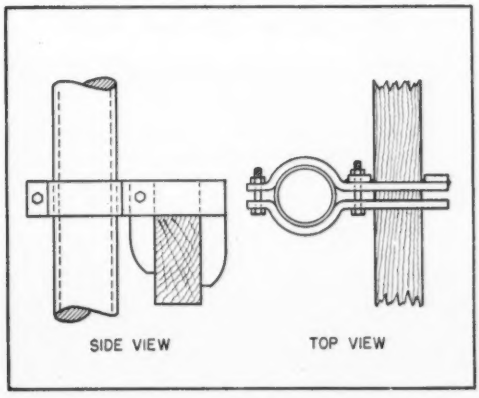
Safety Cables for Skips

At the Empire gold mine of Empire Star Mines Co., Ltd., Grass Valley, Calif., the problem of providing a dependable safety device for skips and truck operating in the incline shaft in event of clamp-pin failure was solved by Phil Keast, master mechanic, with the safety cable arrangement shown here. Parts required include two short ⅝-in. steel cables with eye splice and thimble on one end and a socket on the other, and a special clip with link to hold the cables. Clips used on the hoisting cable are of the Crosby type. The clip holding the cables contains a filler block supporting the link made of ¾-in. round steel. A small welded-on steel stub keeps the link straight in the filler block. Socket ends of the ⅝-in. cables are bolted to the crosshead of the skip or man truck. Adjustment is such that the safety cables do not carry any of the load and still have little or no slack to take up in event of clamp pin failure. The device has been approved by State safety engineers.

Alarm System Protects Air Compressors

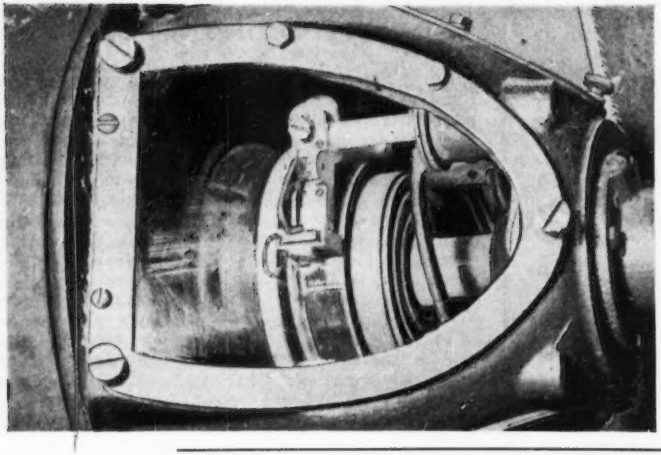
This alarm system has given satisfactory service for many years at a mine plant. It signals instantly if the cooling water supply for the air compressors is interrupted, and brings the standby pump into service if the regular water supply pump fails. Water leaving the compressor jacket flows into a funnel so constructed that it will be held in its lowest position with a normal flow of water. This also keeps contact A open. If water flow ceases, the funnel will rise and close contact A, causing the signal lamp to light up and relay B to close contact C. This in turn energizes the magnet coil of the control device designed to bring the standby pump into operation. As soon as the alarm is sounded, the signal lamp indicates which machine is in trouble, and the pilot lamps show the operator whether or not the magnet coil of the pump control device has been energized.





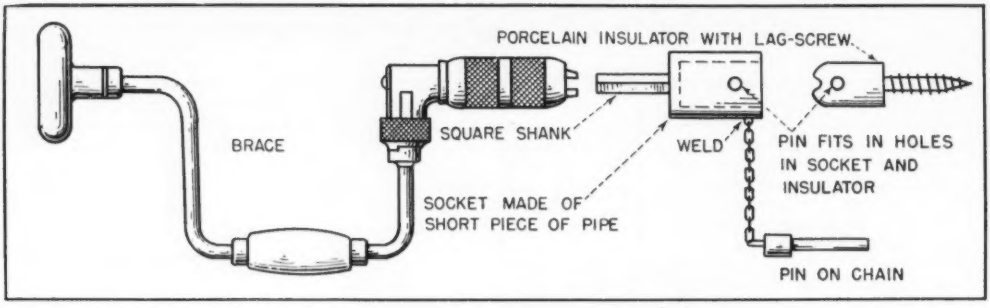
Steel Clamp Holds Pipe in Manway

Carl A. Wesselhoft, foreman in charge of dewatering and retimbering the main three-compartment shaft at the drift gravel gold property of Calaveras Central Gold Mining Co., Ltd., near Angels Camp, Calif., writes that the simple pipe clamp shown here has proven successful in holding the pump discharge columns in the manway. See E&MJ, April 1950. One end of the clamp is fitted with two welded-on clamps. Thus when the clamp is fitted loosely around the pipe, it may be lowered onto the end plate of the shaft sets as shown. Then the bolts are drawn up. This procedure eliminates the time-consuming job of bolting the clamp to the shaft timber or grouting it into the shaft wall. A clamp like this can be installed in a few minutes.



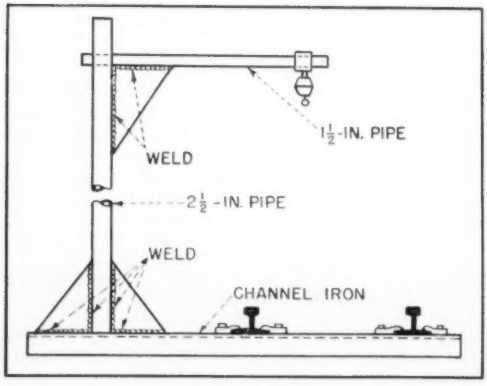
Gold Fish Bowl For Electric Motors

Enclosed motors have their advantages and disadvantages. While they do keep out dust, fumes and moisture, maintenance men may find them more difficult to inspect. But not at the Nekoosa-Edwards Paper Co., Port Edwards, Wisconsin. Here the motors are fitted with plastic covers, as shown in the accompanying illustration. Maintenance men can tell at a glance whether brushes and commutator parts are in working order without removing motor covers. This item is published through courtesy of Westinghouse "Maintenance News."



Quick Way to Mount Insulators

The hard work of screwing in a large number of porcelain insulators fitted with lag-screw ends can be cut down considerably by making a socket out of a short length of pipe to fit over the end of the insulator as shown above. The socket is welded to a short square shank which fits into the jaws of an ordinary brace. A hole is drilled through the socket to admit a short pin which locks the porcelain insulator to the socket after the socket has been slipped over the porcelain section of the insulator. With this equipment, a mine electrician can mount insulators for a long run without tiring, according to Dick May, of Wallace, Idaho, who submits this description and sketch.



Portable Trolley Pole Welded to Steel Tie

The portable trolley pole shown here is giving good service at the Reeves MacDonald mine near Nelway, B. C., Canada. It is used on the main track leading from the River tunnel to the coarse-ore storage bin. The pole differs from conventional units, used elsewhere in that the pole is welded to a steel tie and not installed independently a short distance from the track as is usually the case. Because of this, the trolley wire will remain at a set height above the track regardless of whether the track is depressed by subsidence or dislocated by other causes. Consequently few adjustments are required. It is relatively easy to erect and remove these poles when a track change is planned.

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- Full shift availability, with as much tonnage moving during the last hour as during the first.
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PERSONAL NEWS

James Allen Fraser, graduate of the University of Toronto, has been awarded the E. J. Longyear Co. Fellowship in Metalliferous Economic Geology for 1950-51 at the department of geology, University of Minnesota. Mr. Fraser is at present completing work for the Master of Science degree at the University of British Columbia, Vancouver, B. C. He will conduct experimental work on the influence of high temperatures and pressures on the paragenesis of metallic ores.

WALTER E. REMMERS, has been elected president of the United States Vanadium Corp. A graduate of the School of Mines & Metallurgy of the University of Missouri, he has been engaged in various metallurgical activities of Union Carbide & Carbon Corp., of which U.S. Vanadium is a unit, since 1936.

Dr. Roman Smoluchowski has been promoted to professor of metallurgical engineering at Carnegie Institute of Technology, effective Sept. 1. He was associated with Research Laboratory of General Electric Co., before joining the Carnegie faculty in 1946.

W. L. Ziegler, general manager of Pend Oreille Mines & Metals Co., Metaline Falls, Wash., has been appointed state chairman for Washington of the program committee of American Mining Congress, which will meet in Salt Lake City, in August.

E. P. Thompson, assistant mine superintendent, Hollinger Consolidated Gold Mines, Ltd., has been appointed mine superintendent, according to an announcement by **E. L. Longmore,** general manager of the company.

The U. S. Geological Survey, through the Economic Cooperation Administration, is sending the following U. S. and Canadian technicians to aid the British Government in making colonial mineral surveys: **Burton E. Ashley,** geologist, of Denver, Colo., with headquarters in Zomba, Nyassaland; **Floyd M. Ayers,** geologist, Alhambra, Calif., in Nairobi, Kenya, and **John R. Welch,** mining engineer, Wenatchee, Wash., in Dodoma, Tanganyika, all of whom have already arrived in Africa. Others soon to leave are: **Robert R. Reynolds,** geologist, Shullsberg, Wis., to go to Kaduna, Nigeria; **Allan R. Fawley,** geologist, Winnipeg, Manitoba, Can., to Dodoma; **Roderick Murchison,** Chapel Hill, N. C., to work on fuels in Kenya; **Dan K. Hamilton,** minerals, Chapel Hill, to Kenya; **William Eberth,** mining engineer, New York, to Tanganyika; **C. E. B. Conybeare,** petrologist, Winnipeg, to the Gold Coast; **Walter Lewiecki,** minerals, Silver City, N. M., to Tanganyika; and **Fred R. Waldron,** minerals, Fargo, N. D., to Uganda.

W. F. Brazeau, president of Intsel Metals Corp., sailed May 4th for Europe, where he will spend approximately six weeks in connection with the development of non-ferrous metals, minerals and raw materials for import to the United States. He will also study the steel situation in Europe and will visit Intsel European correspondents in France, Belgium, Holland and England.

Walter Hochschild was elected president of The American Metal Co., Ltd., succeeding **Harold K. Hochschild,** who was re-elected chairman of the board. The new president joined the company in 1920, was made secretary in 1934 and a vice president in 1942. He has been a director since 1928.

FRANK F. RUSSELL, former president of Cerro de Pasco Copper Corp., has been elected chairman of the board.

Henry A. Raymond, manager of the iron ore sales department of Cleveland-Cliffs Iron Co., retired May 1. He will continue to act as consultant on ore sales. **W. McK. Green,** a member of the organization since 1911, succeeds Mr. Raymond. **John S. Wilbur** has been made assistant manager of ore sales.

Dr. William J. Knapp, formerly of the University of Missouri School of Mines & Metallurgy, has joined the engineering department of the University of California at Los Angeles, where he will head a new department of experiment and research in nonmetallic and ceramic materials.

Raymond B. Ladoo, consulting engineer, left May 9 for Ireland, where he will spend three months under contract to the Government of Ireland to advise them as to how their gypsum deposits and other raw materials may best be used to further their industrialization program.

ROBERT P. KOENIG was elected president of Cerro de Pasco Copper Corp. May 10. He has resigned as president of Ayrshire Collieries Corp. Mr. Koenig was engaged in mining engineering and geological work in Peru, Bolivia, Cuba and the Western United States before joining Ayrshire's predecessor company, Electric Shovel Coal Corp. in 1936. In February he was made a director of Cerro de Pasco.

G. H. Niemeyer, president of Handy & Harman, was honored by members of the firm at a dinner on May 1, commemorating his fiftieth anniversary with the company. **J. C. Travis,** vice president, presented Mr. Niemeyer with a handwrought gold cigar box "in recognition of his vision and leadership." Mr. Niemeyer joined the company as an office boy on May 1, 1900. He became Handy & Harman's first salesman in 1902, was appointed manager of the New York plant in 1915, and later became vice president in charge of sales. He was made president in 1938. **Cortlandt W. Handy,** chairman of the board, **R. H. Leach,** vice president, and **H. W. Boynton,** vice president and treasurer, also spoke at the dinner.

R. F. Goodwin, vice president of Federal Mining & Smelting Co., has been elected executive vice president of the company.

Announcing the NEW

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with an exclusive new design that assures smooth action, positive closure, and longer life

In the new Jenkins SWINGTITE Fast-Action Bronze Gate Valve, the exclusive rolling disc and guide track design lengthens valve life and assures maximum tightness as it prevents uneven wear of seating surfaces. As the valve is opened or closed, guide rims around the seating surfaces of discs roll freely over guide tracks cast in the body, distributing wear evenly, dislodging foreign matter, and providing a polishing action for seating surfaces.

The SWINGTITE can be opened or closed instantaneously and easily with less than a quarter turn of the malleable iron lever which activates the self-adjusting ball and socket type double disc.

Wherever full, free flow is essential . . . where valve opening or closing must be instantaneous . . . you will see more and more Jenkins SWINGTITE Bronze Gate Valves setting new standards of performance and endurance. They are recommended especially for such services as laundry machinery, dish-washing equipment, gasoline and fuel oil lines, fire extinguishing steam lines in kitchens, and dispensing lines to tanks or vats.

Get all the facts on the new Jenkins SWINGTITE. Find out how much smoother-operating, how much *longer-lasting* these fast-action Bronze Gate Valves can be when *Jenkins* builds them. Send for the new folder, Form No. 196, containing full details. Jenkins Bros., 100 Park Avenue, New York 17, N.Y. Jenkins Bros., Ltd., Montreal.

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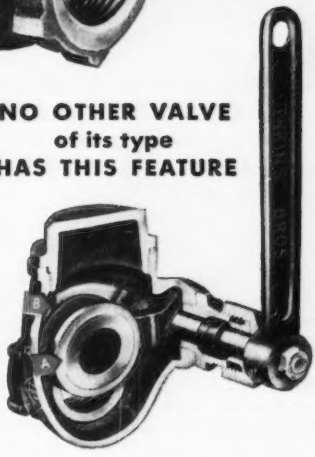
NO OTHER VALVE of its type HAS THIS FEATURE



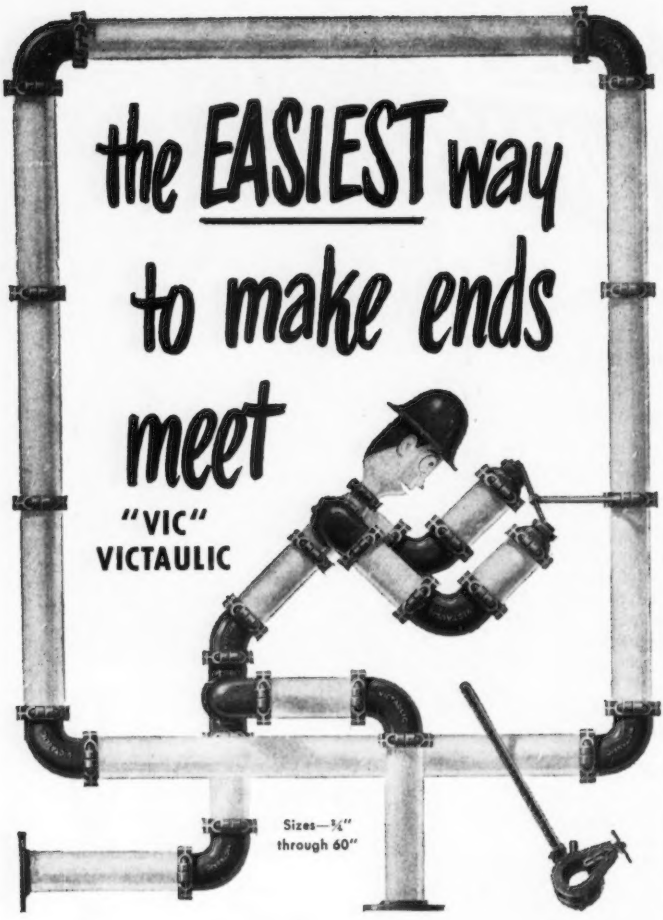
Notice the guide rims (A) of the discs which rotate freely on the guide tracks (B) cast in the body, as the valve opens or closes. This roller action provides a self-cleaning and polishing effect, and also distributes the wear, since the seating position of the discs changes with each closing. Rapid, uneven wear is prevented, and continuous tight closure assured.

JENKINS VALVES

LOOK FOR THE DIAMOND MARK

SINCE 1864 TRADE JENKINS MARK

Jenkins Bros



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You save every way when you *join up* with "Vic"– a simple two-bolt design gives quick, easy hookups, a standard T-Wrench is the only tool needed for connections... joints are positive-locked, leak-proof, will stand up under extreme pressure, vacuum, or strain conditions.

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26TH VICTAULIC YEAR

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PIPE COUPLINGS AND FITTINGS

CHARLES WILL WRIGHT, of Washington, D.C., has been named a director of Behre Dolbear & Co., mineral consultants in mining, metallurgy, geology and management. Other members of the firm are A. F. Banfield, W. F. Boericke, J. F. Geary, Charles H. Behre, Jr., Samuel Dolbear, Parke A. Hodges, A. S. Hecht, G. A. Joslin, R. E. Vivian.

Dooley P. Wheeler, Jr., is now in charge of exploration in the western United States for the American Metal Company of Colorado, with offices at 308 Judge Bldg., Salt Lake City. Mr. Wheeler succeeds **Fred H. Stewart**, who has been transferred to Carlsbad, N. M., as general superintendent of Southwest Potash Corporation, a subsidiary of The American Metal Co., Ltd. **Victor Bongard** has been appointed mine superintendent and W. **Aubrey Smith**, mill superintendent, of Southwest Potash Corp.

Anthony Strojan, Jr., who recently resigned as manager of the Montana mining operations of Winston Bros. Co., Minneapolis, has become associated with the F&S Contracting Co., Butte.

WALTER M. HORNE, assistant manager of the Utah Mining Association for the past 18 months, has been named acting manager, according to Paul H. Hunt, president. He assumed his duties May 1 and succeeds James K. Richardson, who has resigned to join Kennecott Copper Corp. Prior to joining the Mining Association as director of advertising and publicity, Mr. Horne was a sales representative for the California Western States Life Insurance, at Phoenix, Ariz.

C. A. Fredell, manager of Cia. Minera Venturosa, Namiquipa, Chihuahua, Mexico, has resigned to join the staff of San Francisco Mines of Mexico at San Francisco del Oro, Chihuahua.

ROGER V. PIERCE, consulting engineer of Salt Lake City, has become mining mechanization consultant for Mines de Metahambre, Pinar del Rio, Cuba, having been retained by that company on a yearly basis. Mr. Pierce spent the month of February at the mine organizing a program for modernizing and mechanizing the mine's production facilities. He is also consultant for the Duvall Co., which plans to operate a 200-ton cyanide plant and mine in Cassia County, Idaho.

Millan S. Walker, Phoenix, has been elected president of the Comstock Extension Mining Co., Inc., of Globe, Ariz. **Jose Cubitteo, Jr.,** Miami, is vice president and **William Wunsch,** Phoenix, secretary-treasurer.

CARL ZAPFFE, manager of iron ore properties for the Northern Pacific Railway Co., retired May 1, completing 44 years of service with the company. Prior to becoming manager, he served as geologist with the company. He will continue to reside at 325 Bluff Ave., Brainerd, Minn., and as a consultant with the Cuyuna iron ore district.

T. C. Butler, Jr., chief engineer at Simplot Fertilizer Co. since 1946, has opened offices in the Continental Bank Bldg., Boise, Idaho. He will act as a consulting engineer in mining and general engineering.

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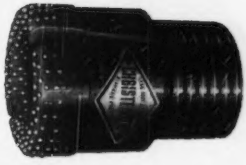
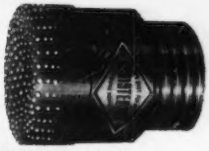


CORE BITS

Christensen Diamond Core Bits are designed and manufactured to perform under all drilling conditions for maximum cutting efficiency and core recovery.



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Christensen Concave Bits can be used profitably for drilling blast holes, leaching holes, drain holes, grout holes or for any other purpose where a core is not required.

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THE GALIGHER COMPANY

AGENTS IN ALL PRINCIPAL FOREIGN MINING DISTRICTS

E. M. PLATTS, sales vice president of Joy Manufacturing Co., has been named executive vice president to succeed the late Arthur S. Knoizen. Mr. Platts joined the company in 1945 when Joy acquired La-Del Conveyor & Manufacturing Co., of which he had been vice president. He began his business career with Jones & Laughlin Steel Corp. in 1913 and later was associated with Pittsburgh & Wheeling Coal Co. In 1929 he established his own manufacturer's agency for mining machinery, which business he conducted until 1932 when he became one of the founders of the La-Del company.

Herbert Bowman has been appointed resident sampling representative in Philadelphia for Lucius Pitkin, Inc., metallurgical chemists and consultants, weighers and samplers. He will serve shippers of primary and secondary metals, scrap and ores to consumers in the Philadelphia area. Mr. Bowman has had extensive experience in metals and ores in Europe and South America as well as in this country.

L. R. Brown, Jr., accompanied by Mrs. Brown, returned to the United States from Bolivia late in April for a four months' vacation. Mr. Brown is a mining engineer and supervisor for the Aramayo Co. in Bolivia and has been recently stationed at the Animas mine. Mr. & Mrs. Brown will spend most of their vacation at Rapid City, S. D., where they formerly made their home.

OBITUARIES

R. R. Millen, formerly a general manager of the Burma Corp., died recently.

Truman Herbert Aldrich, Jr., 77, widely known Alabama geologist, died April 23 in Florence, Ala. A graduate of Purdue University in 1895, he was at one time associated with Sloss-Sheffield Steel & Iron Co. and Republic Steel Corp.

Fred Jones, veteran in the mining field in Colorado, and for more than six years state mining commissioner, died in Denver recently. He was 73. He graduated from the Colorado School of Mines in 1900 and served

for more than 25 years as superintendent of the Portland mine in Cripple Creek.

John McMillan Hayes, 83, long-time Salt Lake City executive of the old Utah Copper Co., died recently in Los Angeles. A native of Belfast, Ireland, he came to Utah in 1886.

Charles L. Montague, 69, retired mining engineer and a member of the American Institute of Mining & Metallurgical Engineers, died April 7 in Santa Barbara, Calif. Mr. Montague was active in the development of copper mines in Mexico and the United States.

Walter W. Bradley, retired state mineralogist of California, died suddenly April 11. He was associated with the Division of Mines for 34 years, acting as its chief from 1928 to 1946. Mr. Bradley had practiced mining engineering in the Mother Lode, in Durango, Mexico, and in Idaho.

ARTHUR S. KNOIZEN, 52, executive vice president and director of the Joy Manufacturing Co., died April 29 in Franklin, Pa. Mr. Knoizen was recognized as one of the foremost mining machinery engineers in the nation, and was widely known in mining circles throughout the United States and Europe. A native of Muskegon, Mich., he joined the Joy Co. at Evansville, Ill., in July, 1923, and successively held positions as shop superintendent, sales manager, and vice president in charge of sales. A few years ago he was elected a director and executive vice president. He was president of the manufacturing division of the American Mining Congress and an honorary member of the Illinois Mining Institute. He was also a member of the American Institute of Mining & Metallurgical Engineers.

William Lincoln Honnold, internationally-known mining engineer, died May 7 in Los Angeles. He was 84. He rose from the position of mine foreman to managing director of Consolidated Mines Selection Co., London. He was a member of the AIME.

Kenneth S. Robinson, 63, mining engineer of British Columbia, died recently at Vancouver. He established

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Better Protection!
GLASS HATS...
Stronger than Steel
It's FIBERGLAS
—resin impregnated. It's remarkably tough—so tough we had to devise new tortures in place of conventional tests to measure its full ability to protect heads. This Hard Boiled Hat is as handsome as they come, in new colors and white . . . or a glow-in-the-dark finish.
More Resilient—This crown is drum-like in its resiliency. We had a heck of a time making a dent in it with ordinary test objects. The hammocks, too, are like hydraulic shock absorbers.
Lighter weight—lighter by a full ounce than former hats, which is another way of saying wearing comfort is again improved.
Coolest to wear of any protective hat made. Laboratory tests, simulating sun's rays, prove that this hat is cooler than any you've ever worn . . . important to any outdoor worker on any job. Job efficiency increases with employee comfort. Floating hammock permits air circulation, encourages further cooling. For winter, snug-fitting, quickly interchangeable liners protect on even the rawest day.
Lifetime resiliency—Retains full resiliency indefinitely. Will not deteriorate or become brittle with age.
Impervious to moisture. High dielectric strength. Passes all dielectric tests.
Choice of color—White or grey are standard. Also available are red, green, or practically any color on special order. Color is impregnated — all the way through — will not fade or deteriorate.
Save money!—One size fits all heads, reduces inventories. Fully adjustable headband and hammock—self-shaping for comfort. 6-second hammock and headband assembly change. Genuine leather headbands optional.
Start saving money today! $4.00 will get you the finest head protection ever built. (Costs less in quantity.) Write
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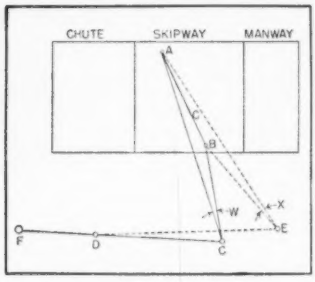
and was president of the Robinson Diamond Drilling Co. in Vancouver.

Fred A. Austin, 73, mining consultant, died in Grass Valley, Calif., March 30. He was chief engineer of the 16 to 1 mine at Alleghany for 20 years before setting up practice as a mining consultant in 1942. Mr. Austin was a past director of the California Hydraulic Mining Association.

LETTERS



To the Editor:

In reference to the article appearing in your April issue, entitled "Shaft Surveying Method Features Accuracy," the use of steel wires for plumbing in shafts where power cables or electric hoists are present is undesirable, since an electric field in the shaft may attract the steel wires and produce serious errors. No. 22 hard copper wire has been found to be the best for plumbing wires. Lead plumb bob weights of 15 lb. in the shape of a cross in horizontal section have been found adequate but are always suspended in water, or water and oil if conditions are bad.

The Weisbach method, using the small angle of 10 min. or less is our established practice, but the calculation involves the small triangles and not large ones with the backsight as one point. It is not good practice to have a short backsight, but one of 100 ft. or more away from the transit if possible and obviously it cannot always be used as a point of a triangle.

In the diagram, the distance BC cannot easily be counted on to equal AB since the focal distance of many transits might be larger than the space between the wires, and there is no good reason for this particular requirement.

We have found that a dozen angles turned from the backsight to each wire, whether swinging or not will establish the position of the wire.

Our established practice is not to move the transit from position C to E but to move the wires from one side of the transit line of sight to the other, thus establishing two separate bearings to carry down the shaft and leaving the transit on a fixed point well marked and available for further surveys.

The calculation of both positions

must check within a few seconds between the transit position and the backsight.

Where extreme accuracy is necessary, wires are suspended as far apart as possible; sometimes in separate compartments, and space for the transit is excavated at the end of the shaft.

If possible, all circulating air should be shut off from the shaft. Since most of our plumbings are done on Sunday, it is not serious to cut off some of the ventilation for a few hours.

One thing in the article attracted our attention; the use of the paper box. We use copper wire with projecting ends, but the box is perhaps a better idea.

WILLIAM A. O'KELLY

Butte, Mont.

Dear Sir:

I should like to take issue with a statement made by Mr. M. A. Kriz in his article on "Gold" (Feb., 1950, p. 79). In speaking of the fact that proceeds from sale of gold in foreign premium markets are only convertible to dollars on the black markets, this writer concludes that "premium gold prices, therefore, are in no way an indication of the intrinsic value of gold."

What, may I inquire, is the *intrinsic* value of gold? Is it not true that the price of gold, or of any commodity, is simply that price which people are willing to pay for it and its holders willing to accept for it? This is subject to fluctuations with different time, place and other conditions. That the U. S. Government by edict imposes upon domestic producers the obligation of accepting $35 per fine ounce does not make this dictated price any more "intrinsic" than any other price. It is merely the price paid by the dominant buyer. Other buyers, operating on the free market, both in the United States and abroad, are quite willing to pay more for gold, and do so regularly and in large quantities. The reason is that they are afraid of paper currency, and probably with good cause. Doubtless, our bureaucrats are anxious to depreciate and conceal this economic fact that the dollar sells at a discount throughout the world vis a vis gold, wherever there is free trading. This discount, far from being an isolated, freakish occurrence, is general, and represents the considered financial judgments of thousands of responsible persons.

Statements of the kind cited are irrational; if not made solely through inadequate knowledge, they propose to conceal the situation for official reasons. Moreover, these kinds of statements are positively harmful to the good cause of general understanding of economics — an understanding necessary that the public may protect itself against the subtle swindling of governments.

WALTER C. STOLL

Tigre, Argentina

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...per YEAR

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They do not require critical adjustment of charge rates—can often be charged direct from the d-c power supply. They can be fully recharged in six to seven hours, which helps get all charging done during off-peak periods.

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KEEPING TAB ON PRACTICE

Radio Helps Open-Pit Work. Instances of the use of radio for communication in open-cut mines are few but the number is growing. The coal industry appears to be several jumps ahead of this. Two installations have already been described in *Coal Age*, one in the July, 1948, issue, and the other in the February, 1950, issue, and there are others.

A recent survey of 26 metal and non-metal mining companies having large open-pit operations disclosed two installations that are discussed briefly in the following. The companies comprised 11 producing non-ferrous metals, 11 engaged in iron mining and 4 producing non-metallic minerals. In addition, two other installations were disclosed at important properties which we hope to take note of soon. Some other operators have the matter under investigation. One, with a recently started enterprise, thinks the situation will call for radio as the workings grow in size.

Further facts regarding the installation in a Southwestern mine which was recently mentioned on this page (*E&MJ*, April, 1950, p. 103), are as follows:

The extent of coverage obtained with the short-wave radio used is variable, due to an occasional "blind spot." In general, it covers the entire pit area, plus all the dump area, and many outlying points such as certain of the townsites.

The sets in operation comprise 1 base-station set, 10 mobile units installed in trucks and pickups, 2 mobile units in line cars, 1 mobile unit in a diesel-electric locomotive crane, and 3 mobile units installed in locomotives. In addition, 11 mobile units are being purchased, to be installed in the rest of the locomotives. All of these units are of Motorola make. The base station is of 30-watt output and the mobile units are of 7½-watt output.

The base station is on the rim of the pit at the so-called lookout station. Communication from any point in the pit or on the dumps is possible with this station. The foremen driving their pickups, the men on the locomotives either in the pit or on the dump, or individuals at any of the other moving mobile units can at all times talk with this lookout base station.

Difficulties met so far have been limited to occasional replacements for tubes.

Advantages of the installation are reported by the superintendent to be varied and manifold. If trouble occurs, the foreman is able to contact the lookout station attendant immediately, who can telephone his wants, or the foreman can contact other foremen or other units as he may need. Foremen are also able to talk to one another on their inspection rounds and can plan to make any moves necessary, and everyone is immediately informed of any change to be made. Transportation difficulties can be ironed out immediately. In general, the installation of the radios has helped reduce delays and made operation smoother.

Radio for Florida Phosphate Mines. A construction permit has just been issued by the Federal Communications Commission to International Minerals & Chemical Corporation, Chicago, for a radio communication system to be installed at its phosphate mines in the Florida pebble field. J. G. Ivy, electrical engineer for International, has supplied the following information, with the consent of Franklin Farley, vice president in charge of the company's phosphate division.

International's Florida phosphate mines consist of three open-pit strip mines situated at driving distances of 4, 12 and 16 miles from the company offices and maintenance facilities. All major replacement parts are warehoused near the central maintenance shops and most of the crews are based at this central point. Such an arrangement means that the maintenance personnel must spend up to 50% of their time driving from one mine location to another and back to the maintenance shops at which they are based.

The purpose in installing radio is to permit contact with these individuals while they are in the field and in their cars between jobs. The system consists of a 60-watt base station located near the maintenance shops, and 16 mobile units located in the automobiles used by the maintenance personnel. Two of the mobile units will be located on draglines at the mines.

The system will operate in the 152-162 mc band, using frequency modulation. The equipment is being manufactured by Motorola.

Inasmuch as the system is not yet in operation, the company cannot foretell what difficulties will be encountered or what advantages will be gained from its use. Use of the system is expected to give a substantial saving in maintenance cost by permitting the men needed for repairs to be called promptly to the scene of any breakdown, and, having diagnosed the trouble, to communicate with the maintenance shops and obtain promptly the proper repair parts and necessary crews and tools. Savings resulting from increased production time will probably exceed those made in actual maintenance cost. However, it is very difficult to evaluate such savings precisely.

Some open-pit operations depend on telephone communications. A typical company has a telephone system serving its quarry, with Teletalk instruments in its concentrator, various shops, warehouse and tramway terminals, as well as in the works office. The use of radio, however, extends the advantages thus derived to any number of mobile stations.

The first of the two installations in the coal industry, mentioned in the opening paragraph, is at the strip mines of Sunlight Coal Co. and the affiliated Tecumseh Coal Corp., near Boonville, Ind. (See *Coal Age*, July, 1948, pp. 79-81.) Recommended by General Electric Co., it consists of one 50-watt Type ES-3-A standard wall-cabinet land station, at the main office, and 12 15-watt Type ES-1-A mobile units, installed on each of the two 40-cu. yd. and one 30-cu. yd. stripping units, also on cars of supervisors, etc. The second installation (*Coal Age*, Feb., 1950, pp. 102-105) serves the stripping operations of the Sherwood-Templeton, Central Indiana, and other coal companies in southern Indiana. The latter system, also provided by Motorola, Inc., operates from four base, or fixed, stations, three stripping units, three supervisory cars and one service truck.

Carbide-Tips at Bishop. Still another user of carbide-tipped forged steel in the Bishop, Calif., area is U. S. Vanadium Corp.

In general the ground is hard. One-inch hex. stoper steel is used in sets of four lengths and in standard changes of gage, starting at 1⅝ in. and dropping 1/32 in. with every change. The forged bit is of the 4-point cross type.

Results have been good, though time has been insufficient for obtaining worth-while data. No trouble has been had with shanking. Used however, with Leyner-type drills this steel may shank and have to be cut back to the next length. Nipping presents no problem. The carbide tips must be sharpened when dull to obtain the full benefit of them.

The company buys its inserts, upsets the steel, and has the inserts set by O. J. Black's shop in Bishop. The steel is bought in sets of 25, or 100 pieces at a time.

Twin 500-barrel Hiboy Bolted Steel Tanks with Safwalk Walkway

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And there is much more to recommend BS&B Tanks in addition to portability. They have proved their ability in containing all types of materials. Bolted Steel are ideal for oils, water, even aviation gasoline. BS&B wood tanks are employed the world 'round for water, brines corrosive fluids and settling systems.

They're soundly engineered for long, long life. Weatherproof and tight as a bottle. Even inexperienced labor can erect them quickly. Many sizes available from stock. EXPORT SHIPMENTS A SPECIALTY.

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IRRIGATION TUNNEL HOLED THRU EARLY TODAY; EXPECT WATER BY MAY 1
Member Associated Press Full Leased Wire
THE DAILY SENTINEL
2,240-Foot Bore Being Completed Over Month Ahead of Schedule
Cleanup Work Already Underway So First Water Can Be Turned In As Soon As Possible, Speed Record Set In Both Drilling and Contracts
DAILY SENTINEL PHOTO:
TUNNEL HOLED THRU
Browder Spike Mc
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a race against time that the whole country watched!

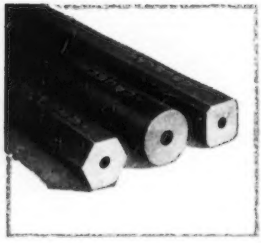
Boring and blasting through a mountain to save a peach crop from disaster, the Grafe-Callahan Construction Company and Rhoades Shofner Construction Company holed through *weeks* ahead of a 72-day penalty deadline. Crucible Hollow Drill Steel was used exclusively. Here's the story:

Water means wealth to the Grand Valley in Mesa County, Colorado. A tunnel running through a mountainside near Cameo was the vital link in carrying this precious water. Then disaster struck. A mountainslide crushed the tunnel and threatened drought to 30,400 acres of peach and garden crops valued at upwards of $3,000,000.

Speed was all important, and a contract was awarded to the Grafe-Callahan Construction Company and Rhoades Shofner Construction Company of Texas to build an emergency tunnel. Penalty clauses were inserted to be enforced if the scheduled date was not met. But more important was the fact that valuable crops were threatened with destruction every day after May 28 that water didn't flow.

Working day and night under the direction of Project Manager B. A. Peters, drilling crews holed through 100 feet a day to complete the 2,240-foot tunnel over a month ahead of schedule. Of this gruelling job, Mr. Peters says:

"It took good men and good tools to do the job, and Crucible Hollow Drill Steel helped us beat the deadline." CRUCIBLE STEEL COMPANY OF AMERICA, Chrysler Building, New York 17, N. Y.



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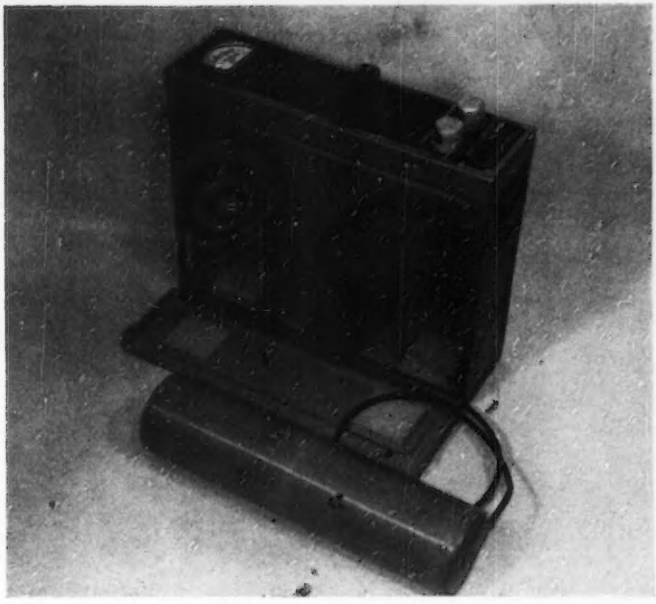
NEW PRODUCTS DIGEST

For further information on these products, circle item numbers on card—insert and mail.

PREVIEW



1

Scintillation Counter Aids Uranium Search

A NEW GAMMA-RAY DETECTOR, claimed to be 100 times as sensitive as conventional portable Geiger counters, is announced by Halross Instruments Corp., Ltd., Winnipeg, Canada. This increased sensitivity, with negligible effects from cosmic rays, permits more rapid and accurate measurement of gamma-ray field intensity. The new device is called the Model 939 Scintillometer, and employs the scintillation principle which may be explained as follows:

When alpha particles, or beta or gamma rays emitted by radioactive ores strike certain crystals such as zinc sulphide, fluorite, or scheelite, the rays or particles excite and ionize the molecules of the crystals. These molecules then radiate energy in the form of light, i.e., scintillate. The flashes emitted can be observed and counted visually with the aid of a low-power microscope. However photo-electric scintillation counters employing electronic circuits, such as the Scintillometer, are much more effective in detecting and counting the flashes.

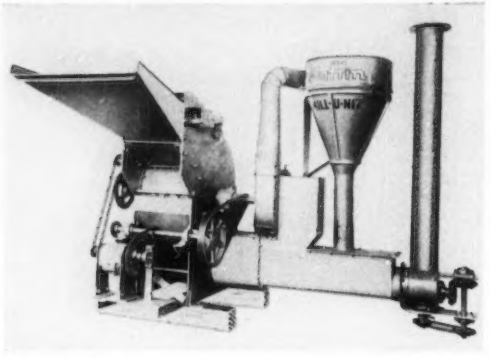
When used for radioactive ore surveys, the Scintillometer will detect deposits through greater depths of overburden and provides information which can be correlated with geological structure. Through the use of a special gamma-ray spectrometer feature, the Scintillometer may be used to distinguish between uranium and thorium ore deposits, and will indicate the uranium concentration in an ore containing both radioactive minerals.

The unit employs only high vacuum tubes, and is protected against vibration, shock, temperature and humidity. The instrument will operate continuously between—20 deg. F. and 110 deg. F., with a relative humidity of 95%. A removable probe is contained in the lower section of the case which can be removed for laboratory research purposes. The case is of aluminum alloy, measuring 3½x11½x13 in., and is supplied complete with batteries and canvas carrying case and strap.

In recent exploration work with the Scintillometer in Saskatchewan, counting rates up to 250,000 per minute were recorded over a pitchblende-bearing vein. (Economic Geology, Feb., 1950, p. 168.)

SIDE-DUMP truck body features hydraulic dumping and fully automatic down-folding side gate. Model BD-116H has 16-ton capacity but same design is available in large sizes. Easton Car & Construction Co., Easton, Pa. (2)

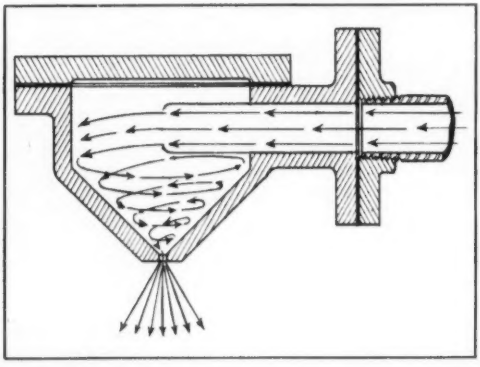
JEEP with extra-long dump body handles 2 tons of ore per trip underground. The four-wheel drive war veteran was converted by miners to use butane to eliminate deadly carbon monoxide. Willys-Overland Motors, Inc. (3)



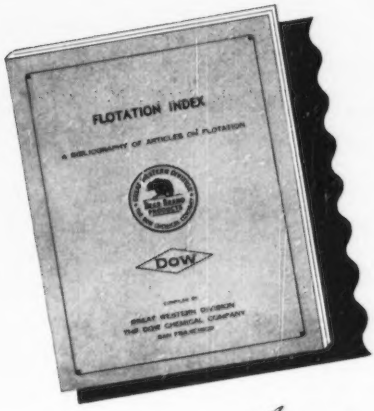
MILL UNIT grinds and pulverizes material in hammermill, collects 95% of dust. Screw conveyor carries ground material to desired height. Uses diesel, electric or gasoline motor. Daffin Mfg. Co., Lancaster, Pa. (4)

ALUMINUM ALLOY SHELLS for drilling machine are lightweight, strong as steel shells. Accommodate steel changes up to 5 ft. Can be turned end for end for longer wear. Gardner-Denver Co., Quincy, Ill. (5)

HOPPER TRAILERS dumping as they move forward, create a stockpile over the area that can easily be handled by a scraper system. Dumping is manually controlled. Fruehauf Trailer Co., Los Angeles, Calif. (6)



CYCLO-SPRAY discharges water with cyclonic action for washing ores. Cone shape imparts whirling motion to water as it enters top at a tangent. Moderate pressure required. Pyramid Screen Co., New York. (7)



Announcing

20th Annual Additions to the FLOTATION INDEX

To maintain the most complete, authoritative guide to published material on the flotation process . . . request our twentieth annual supplement for your BEAR BRAND FLOTATION INDEX. Many of the listings and descriptions of books and articles in the 1950 compilation are of particular note.

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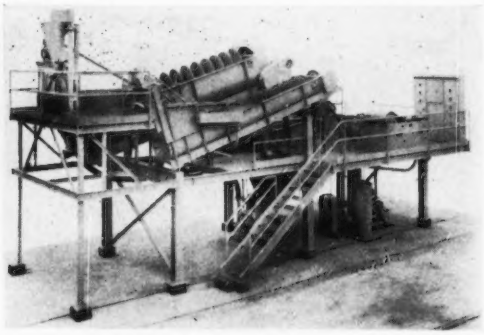
LANDING STRIP at Stibnite, Idaho, means transportation all year around for men and supplies at Yellow Pine Mines. More and more mining men are using planes like this Navion to save time and money in traveling between remote areas. Ryan Aeronautical Co., San Diego, Calif., makes the Navion. (8)



HEAVY-MEDIA SEPARATION PLANT destined for the Philippines, is first SWECO plant to be exported. Operated by one man, it produces middling as well as sink and float products, providing wide flexibility. Unit is manufactured by Southwestern Engineering Co., Los Angeles Calif. (9)

Memos from the Manufacturers

F. J. McNiff has joined **Crucible Steel Company of America** as the representative of the stainless steel sales department in the Atlantic seaboard region.

Edwards Co., Inc., manufacturers of electrical signaling and communication equipment, have announced the appointment of **John L. Taylor** as sales manager.

Huck Mfg. Co. has promoted **Robert N. Hendrickson** to vice president in charge of sales engineering and **Frank A. Dobbe** as vice president in charge of sales.

R. A. Roosevelt has been promoted to the position of sales manager by **Eriez Mfg. Co.**

Whiton Machine Co. (Conn.) says that **W. E. Pearson Co.** of Seattle is their representative in the state of Washington. **T. C. Chown, Ltd.**, of Montreal is the Canadian agent.

Battelle Memorial Institute has appointed **Dr. Hamnett P. Munger** to coordinate its air-pollution research activities.

Taylor Forge & Pipe Works (Chicago) has a Canadian subsidiary, rather aptly named Taylor Forge & Pipe Works of Canada, Ltd.

The Euclid, Ohio, plant of **Joy Mfg. Co.** has been purchased by the **Lewis Welding & Engineering Corp.** of Bedford, Ohio.

T. H. Anderson has been appointed sales engineer for **Kensington Steel.**

James H. Binger has been elected vice president and general manager of the Belfield Valve Div. of **Minneapolis-Honeywell Regulator Co.**

David K. Stuart and **Richard J. Rand** have been appointed manager and assistant of the Pittsburgh branch of **Crucible Steel Company of America.**

Mine Safety Appliances Co. has opened a new and larger warehouse to serve eastern New York and Connecticut.

J. V. Doll has joined **Mack-International Motor Truck Corp.** as vice president, fleet sales.

Charles L. Morris, Jr., has been appointed assistant director of Technical and Plant Personnel Div. at Stamford Research Laboratories of **American Cyanamid Co. Quintin T. Dickinson** has been named manager of the New Coal Tar Chemicals Dept. at Bound Brook, N. J.

Birdsboro Steel Foundry and Machine Co. has appointed three new agents. **Miller-Joyce** (Los Angeles) and **Whittey Engineering Co.** (Boston) will handle hydraulic presses. **J. R. Allen Co.** (Cleveland) will handle steel castings.

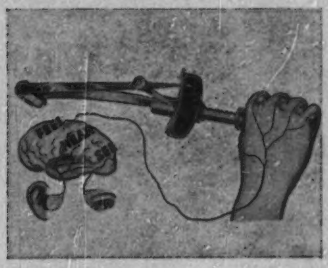
PUMP weighs about half of standard pump of same size. Has 5-hp. gasoline motor, is rated at 250 gpm. Price: $325. Available: McCulloch Motors Corp., Los Angeles, Calif. (10)

TOOL STEEL SELECTOR covers 98% of tool steel applications. Only tool or die characteristics need be known. Available free. Crucible Steel Company of America, N. Y. (11)

Equipment Shorts

ALERTNESS INDICATOR. A portable "alertness indicator which signals lethargy in persons doing monotonous jobs has been developed for the Navy's Special Devices Center. An electronically controlled recorder measures levels of alertness and sounds warning when they are dangerously low. It has been tested on pilots and truck drivers. (31)

FLOW METERS. "Ratosleeve" is a variable area-type flow rate instrument. Has only one moving part, requires no seal pots. Handles liquid flow capacities from 4.5 to 6,200 gpm and gas flow from 12.5 to 12,500 cfm. Mountings for plain visual indicators, secondary recorders, controllers, and integrators are identical and interchangeable for all sizes. Fischer & Porter Co., Hatboro, Pa. (32)



WRENCHES. "Faster than thought" is the speed of new "Proto" torque wrenches, because they depend on instantaneous, involuntary reflex muscular reactions. A trip lever is set at the desired torque reading. When the wrench is pulled to this exact reading, the lever trips a signal trigger. A strong, definite impulse is imparted to the hand and a loud click is sounded. Resulting sensations of feeling and sound cause the operator to release the wrench at desired torque setting. Available: Plomb Tool Co., Los Angeles, Calif. (33)

PORTABLE ELECTRICAL INSTRUMENTS. Line of portable instruments is rated in 2% accuracy class. Dimensions are 3 5/16 x 4 1/4 x 1 25/32 in. Ammeters are available in full scale ranges from 20 microamperes to 50 amp. d.c., and from 5 milliamperes to 50 amp. a.c. For d.c. voltages the full-scale ranges from 10 millivolts to 800 v., with a.c. ranges from 1.5 v. to 300 v. Rectifier milliammeters are in the 0.5 to 10 milliamperes range and rectifier voltmeters from 2 v. to 800 v. Available: Westinghouse Electric Corp., Pittsburgh, Pa. (34)

SOIL SAMPLING KIT. Compact, versatile, hand-operated soil sampling kit will take accurate samples at depths of 25 ft. Among uses are testing clay deposits, foundation test borings, sampling gold-bearing sands, exploring sand and gravel deposits. Available: Acker Drill Co., Inc., Scranton, Pa. (35)

PIPE BENDER. Hydraulically operated model of the Hossfeld Universal pipe, bar and angle iron bender consists of motor, pump, cylinder and foot control which leaves both hands free to manipulate the material being bent. Full 180-deg. bends can be made on standard pipe up to 2-in. in diameter. Relief valve prevents overloading. Available: Hossfeld Mfg. Co., Winona, Minn. (36)

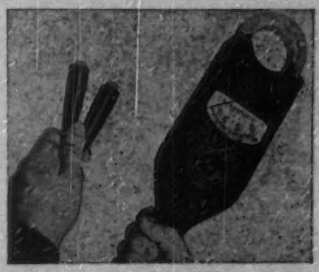
PORTABLE CHAIN CUTTER. Lightweight guillotine, operating on any 100-psi. compressed air source, quickly cuts ¾-in. stainless steel and Monel rod, one-in. mild steel, one-in. soft chain and ¾-in. hard chain. Available: Manco Mfg. Co., Bradley, Ill. (37)

SAMPLING MOIL. Carbide tipped sampling moil is said to give 25 times more footage and faster operation. Available: Hayes Steel Products, Ltd., Merriton, Canada. (38)

HOSE. "Vari-Purpose" hose will handle satisfactorily all the following materials: air, water, oil, grease, paint, alkalies, oxygen, solvents and many other liquids. Sizes from ¼ in. ID (11c. per ft.) to 1 in. ID (42c per ft.) Working pressures 250 to 300 psi. Carlyle Rubber Co. (39)

LUBRICANT ADDITIVE. Manufacturer claims that "Power Ball Friction-Proof Oil" will instantly boost the lubricity and performance life of any oil or grease. Will prevent "freezing" of moving parts under terrific pressures. Available: Power Ball Oil Co., Columbia, S. C. (40)

GREASE GUNS. "One-man, one-hand greasing outfit" comprises a loading pump mounted on steel cover which fits standard lubricant pail, and grease gun. After loading, gun is disconnected from pump before using. Model 7185-A, "Dyn-O-Luber" weighs 2 lb., greases up to 55 bearings, costs $19.95. Model 7185-B "Dyn-O-Pistol," has 9-oz. capacity, costs $13.95. Available: Alemite Div., Stewart-Warner Corp., Chicago, Ill. (41)



HOOK-ON WATTMETER. Power measurement without service interruption is possible with Type AK-2 hook on wattmeter. It uses a removable magnetic hook to surround the current carrying wire. Potential leads are connected as in a conventional single-phase wattmeter. In addition, a 3-phase balanced power measurement is possible by passing two power leads through the hook, and connecting the potential leads to these same power leads. Switch selects any of 6 ranges from 3 to 300 kw.: General Electric Co., Schenectady, N. Y. (42)

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June, 1950

Please send me the catalogs or further information about the items from New Products Digest whose numbers are circled.

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2	9	16	32	39	46	72	79	86
3	10	17	33	40	47	73	80	87
4	11	18	34	41	48	74	81	88
5	12	19	35	42	49	75	82	89
6	13	20	36	43	50	76	83	90
7	14	21	37	44	51	77	84	91

My Name _____ Position _____

Company _____

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For Your Files

This informative manufacturers' literature is free unless otherwise specified. To obtain bulletins circle their numbers on card below and mail.

BATTERIES. "Instructions and Technical Data for Rubber Jar Batteries" discusses care and operation, maintenance repairs and replacement parts. This 36-page booklet (GB-748), issued by Gould Storage Battery Corp., Trenton, N. J., also contains technical data and theory of the lead acid storage battery. (71)

CATERPILLAR PRODUCTS. Well illustrated booklet includes complete information on new products as well as on the complete line of equipment built by Caterpillar Tractor Co., Peoria, Ill. (72)

CRANE AUXILIARIES. Illustrated catalog, #200B, offering special data on hooks, slings, grips and tongs for handling loose bundles, heavy objects or odd shapes, has been released by Downs Crane & Hoist Co., Los Angeles 37, Calif. (73)

GEAR REDUCERS. Bulletin describes single, double and triple herringbone gear reducers for capacities up to 1,000 hp. Contains complete horsepower and overhung load rating tables, dimensions and weights. One section of this De Laval Steam Turbine Co. (Trenton, N. J.) bulletin, H-HS, tells how to select reducers and gives examples. (74)

PUMP. Folder (B-592) describes vertical centrifugal pumps made by Peerless Pump Div., Food Machinery and Chemical Corp., Los Angeles, Calif. Capacities up to 5,000 gpm. can be obtained. Maximum head is claimed to be 1,500 ft. (75)

ROD MILLS. Hardinge Co., Inc., York, Pa., has just published revised literature on rod mills. Bulletin 25-B shows numerous installations, construction details, specifications and performance data. Also discussed is new type Convex-Head Hardinge Rod Mill. (76)

JIG. "The Dorrco Pan-American Pulsator Jig", a 6-page bulletin, No. 2402, contains a complete description of the unit including photographs, drawings and a table of dimensions for both single and double hutch models. The Dorr Co., Stamford, Conn. (77)

ELECTRIC CABLE. Light, easy-to-splice, moisture-resistant Simplex-Anhydrex rubberjacketed cables are described in 15-page booklet issued by Simplex Wire & Cable Co., Cambridge, Mass. Tables give necessary information for the 0-2,000-v. working range. (78)

PUMP. Bulletin W-318-B21 (4 pages) on Worthington two-state, double suction centrifugal pump is now available from Worthington Pump and Machinery Corp., Harrison, N. J. (80)

BLOWER. Four-page folder gives engineering layout, application and design data and ratings at listed rpm. for Standardaire blower, made by Standard Stoker Co., Inc., New York, N. Y. (81)

ROOF BOLT. "Pit Bolt" expansion unit and split rod methods of supporting mine roofs are described in detail in 8-page bulletin published by Pittsburgh Screw & Bolt Co., Pittsburgh, Pa. (82)

ELECTRIC MAINTENANCE. "Care of AC Rotating Equipment" is a helpful 24-page manual on both preventive maintenance and general repairing of electrical machines. Allis-Chalmers Mfg. Co., Milwaukee, Wis. (83)

REPLACEMENT PARTS. Catalog gives comprehensive data on brake linings and clutch facings for shovels, draglines, tractors and industrial equipment. Included are friction material recommendations for specific parts. Grey-Rock Div., Raybestos-Manhattan, Inc., Manheim, Pa. (84)

HOSE. A new all-service hose (Servall) has been announced by Hewitt Rubber Div. of Hewitt-Robins Inc., Buffalo, N. Y. A 6-page envelope size bulletin has been issued to present facts about its features of design and construction. (85)

WIRE CLOTH. Comprehensive 62-page catalog on wire screen and wire cloth products has been issued by Newark Wire Cloth Co., Newark, N. J. General information on screens and cloth is well organized and specific data on the company's products are presented. There is also a complete section on testing sieves. (79)

CONTROL DEVICES. Minneapolis-Honeywell Regulator Co., Philadelphia, Pa., has published a 64-page catalog of over 100 different models of non-indicating electric, electronic and pneumatic controllers with numerous industrial applications. (86)

REFRACTORY CONCRETE. "Lumnite Refractory Concrete," published by Lumnite Div., Universal Atlas Cement Co., New York, N. Y., gives detailed information on refractory concrete mixes. (87)

DRILL BITS. Illustrated 12-page catalog describes and gives specifications of all Hawthorne replaceable blade drill bits, and discusses results of recent tests. Herb J. Hawthorne Inc., Houston, Tex. (88)

CONVEYORS. Handbook published by the Pioneer Engineering Works, Minneapolis, Minn., shows how you can solve your conveyor problems and how to determine specifications for ordering the conveyor you need. Is well illustrated, contains 52 pages. (89)

LUBRICATION. "Eleven Ways to Cut Production Costs" is a pocket-sized primer on industrial lubrication by Alemite Div., Stewart-Warner Corp. (90)

CORROSION-RESISTING LININGS. Leaflet tells how any wooden or steel tank can be easily lined with a permanent corosion-resisting coating of any thickness from 1/16 in, as simply as plastering a wall. Carboline Co., St. Louis, Mo. (91)

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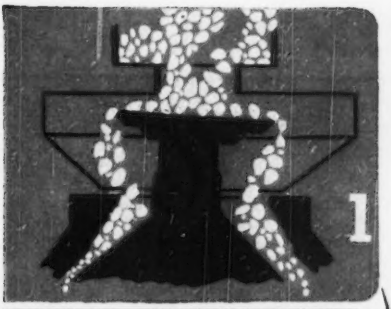
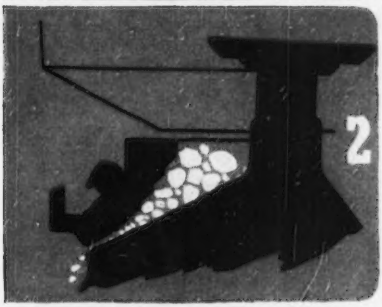
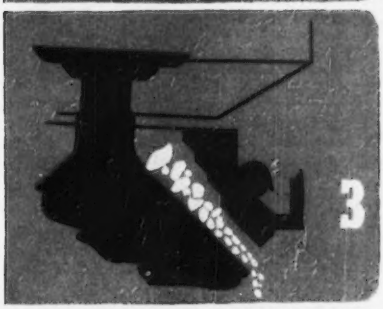
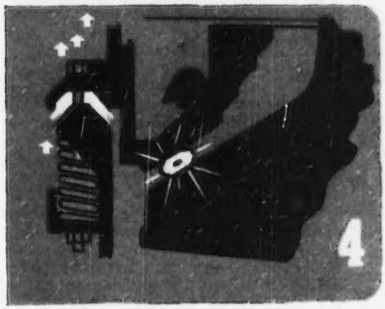
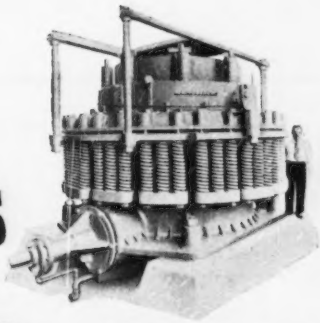








4 BIG REASONS why *Symons Cone Crushers* lead in the fine crushing field



1 uniform controlled feed

Feed platform with adjustable spout in conjunction with the oscillating feed plate combine to control and uniformly distribute the feed to the crushing cavity.

2 maximum liner utilization

With the Symons process of crushing, the crushing action occurs throughout the entire length of the cavity. Uniform manganese wear means minimum scrap loss and low manganese cost per ton of crushed product.

3 large discharge area

Wide throw of head creates a large opening for free and rapid discharge of crushed fines. This allows rapid entry of new feed into the cavity, an essential factor for big capacity.

4 protection from tramp iron

The circle of heavy springs permits the bowl and adjustment ring to rise to allow a non-crushable object to pass through without damaging the crusher. After the tramp iron is discharged the crusher automatically returns to its original setting.

These are but a few of the exclusive Symons Cone features that make possible the enormous output of fine product which has won for this crusher the position of world leadership in the fine crushing field.

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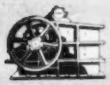
NORDBERG MACHINERY C 501

NORDBERG *Machinery for processing ores and industrial minerals*


Jaw Crusher

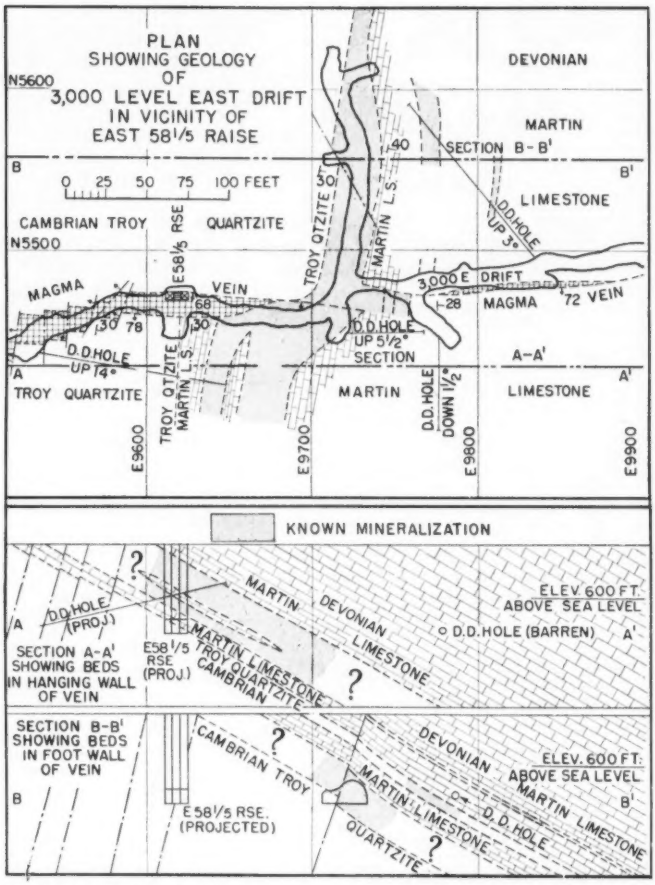
Rotary Kiln

Vibrating Bar Grizzly

Symons Rod Deck Screen

Mine Hoist

Diesel Engines



HIGH-GRADE COPPER ORE has been found in a drift on the 3,000 ft. level about 2,000 ft. east of the main Magma workings. This is the first occurrence of replacement ore at the mine. How much and how rich remain to be seen.

New Ore for Magma?

RECENT DISCOVERIES of new ore at Magma Copper Co., Superior, Ariz., have opened possibilities that could be of considerable importance. High-grade copper ore of the replacement type, was recently exposed in an exploration drift about 2,000 ft. east of the easternmost ore shoot developed on the main Magma vein.

This is the first occurrence of replacement ore thus far found in the Magma mine.

All of Magma's ore has to date come from the so-called Magma vein. It is actually a mineralized fault that cuts down through about 6,000 ft. of limestone, quartzite, shale, diabase and schist. The vein trends east and west and dips at 70 deg. The strike of the sedimentary beds is north-south, and they dip at 30 to 35 deg. east.

The old Magma orebody has averaged about 5.4% recoverable copper with varying amounts of zinc, gold and silver. Chief ore minerals are chalcopyrite, chalcocite and bornite. The orebody rakes steeply to the west, and has averaged about 10 ft. in width, with a maximum of 30 ft.

The new discovery was found on the 3,000-ft. level of the Magma mine in a drift sent out east along the Magma vein. This drift passed from the diabase into the sedimentaries, and worked on through Cambrian shale and quartzite, finding a short shoot of vein ore. But just beyond the contact between the Cambrian "Troy" quartzite and the Devonian "Martin" limestone, the drift struck what proved to be a replacement type of ore, lying within the Martin limestone just above its contact with the underlying Troy quartzite. This contact is known to be mineralized over a length of several miles in the Superior area, but the Magma discovery is the most important showing yet found on it.

Accompanying drawings show the exploration so far completed to determine the extent and value of the replacement ore. So far the mineralization has been traced for 145 ft. north and 40 ft. south of the main Magma vein. The mineralized zone is about 20 to 30 ft. thick, normal to the bedding. The replacement ore is principally massive sulphide, with pyrite predominating and considerable specular hematite showing in the upper portions of the mineralized beds. The principal copper minerals of the new discovery are chalcopyrite and bornite.

A typical section across the replacement zone assayed: 5.45% copper; 0.9 oz. silver; and 0.02 oz. gold over 27.4 ft. The best portion of this section assayed: 8.54% copper; 1.7 oz. silver, and 0.04 oz. gold over a width of 13.7 ft.

Magma's findings may repeat the history of the Old Dominion mine at Globe, in reverse. In its 50-yr. life, the Old Dominion obtained the greater part of its 700,000,000-lb. copper production from orebodies of the replacement type in Cambrian and Carboniferous limestones. These orebodies apparently originated with diabase intrusions. In its later years, the Old Dominion worked a good many orebodies of the fissure type in the diabase or quartzite, that it would have by-passed in the earlier days of production from the high-grade replacement ore.

How much the new discovery will mean to Magma's future remains to be seen. It may be a year or more before enough exploration is done and further geological information is available for a practical evaluation. Meanwhile, its character as a replacement orebody makes it extremely interesting, and its potentialities as a target for forthcoming exploration at Magma, make it extremely important.

IN MINING

IN THE UNITED STATES

- Lead Industries Association Meets—P. 114
- Lake Navigation Opens "In Reverse"—P. 120
- AEC Investigates Wyoming Uranium—P. 126

ALASKA

★**Yukon Consolidated Gold Corp.** plans to conduct operations this year on much the same scale as last year, with eight dredges, five thawing plants and four stripping plants. Dredges will be operated on lower Klondike, Bonanza, Hunker, Quarters, Granville, Dominion and Sulphur Creek. Some 450 men will be employed, according to Grant Barrett, who is now mining superintendent as well as chief engineer.

★**Moore Creek Mining Co.** is moving its equipment to Taylor Creek on the Holitna River, where it has 36 claims to work. Nineteen sleds were used to carry the equipment 260 mi. from Moore Creek. To cross the Kuskokwim River, Nick Mellick pumped water on the ice to build an ice bridge 6 to 8 in. thick.

★The 3½-ft. Candle Creek bucket dredge of Strandberg Brothers will be operated this summer for the first time since 1941, according to William Strandberg of Fairbanks. The firm already is operating on Utopia Creek but has closed down operations on Cripple Creek near Folger. Candle Creek is below McGrath on the Kuskokwim River.

★Late in April **U. S. Smelting, Mining & Refining Co.** began preliminary stripping on Fairbanks Creek, and preparatory work on Engineer and Dome Creeks. A small crew started work on Long Creek ditch camp at Mile 44 on the Steese Highway. Preparations also began to open the 70-mi. Davidson ditch for furnishing Chatanika, Dome and Goldstream with sluicing water.

★**Callahan Zinc-Lead Co.** of the Couer d'Alenes in Idaho, which owns 74% of Livengood Placers under new agreements with RFC, started a rehabilitating program late last year. Stripping and thawing are planned for this season but dredge work will not begin until 1951.

★John Gibbons and Myrna Perkins, city clerks of Kodiak, have staked a gold claim near Mission Creek beyond Kodiak Baptist Mission. The notice was posted March 20.

★**Aluminum Company of America** confirmed reports on April 12 that it is considering locating a plant near Skagway, but said no decision was possible at the present time. "The whole thing is in the realm of consideration only," a spokesman for the company said.

ARIZONA

★Development work at Tiger, where the **San Manuel Copper Corp.** has been granted a patent on a 500,000,000-ton deposit of .08% copper, will be stepped up. The low-grade deposit is believed to be the largest undeveloped copper body in the United States.

★An on-or-off-the-job health and accident and sickness benefit plan has been ratified by employees of all **Miami Copper Co.** operations. The plan is a co-operative one with employee playments based on earnings. The insurance meets demands of unions and had been a prime issue in recent strike threats and settlement negotiations.

★Arizona's Corporation Commission has dismissed a citation against the **Rio Del Monte Mines, Inc.,** and reinstated its stock selling permit. The company plans further development of gold, lead and zinc properties.

★Three previously unknown uranium minerals found in the Hillside mine in Yavapai County have been named by the U. S. Geological Survey. Found at the 300-ft. level by Dr. Charles A. Anderson, survey geologist of Prescott, Ariz., the minerals were named Andersonite, Swartzite and Bayleyite. The survey said they are technically hydrous, uranyl carbonates of magnesium, or sodium and calcium, and of calcium and magnesium and are of only scientific interest.

★Ore samples from the **Papago Chief mine** in Pima County 65 mi. from Tucson have been assayed as U_3O_8 of at least 4.33%. The ore was found by J. B. Woolsey of Las Vegas, Nev., and Art Kistler, Monte Bello, Calif.

CALIFORNIA

★The gold fields in Sierra County are the scene of increasing activity, with some 20 properties being operated in the Alleghany, Downieville, Goodyear Bar, Forest and Sierra City districts.

The **Oriental Mine** in the Alleghany will step up production during the summer, going into full operation on the 75-ton mill which was activated last November.

Dickey Exploration Co. is drifting from a 1,400-ft. crosscut channel to reach the Gold Star property's gravel channel. **Gold Crown Mining Corp.** has reconditioned an old shaft on the Wonder No. 2 claim of its Gold Crown group. The Pilgrim and American Hill mines in this district are being put into action, having been taken over by the Cadmus Mining Co.

Sierra Monarch Gold Mining Co. is preparing to mill 100 tons daily at its Monarch property in the Sierra City region. **Ace High Mining Corp.** plans expansion of its operations at the Keystone. Development work is under way at the Primrose, Pride and other lode gold mines in the area. Gastongay & Rasmussen have installed a dragline dredge on placers 3 mi. above Sierra City.

Operations have resumed at the **Brush Creek gold mine** in the Goodyear Bar area. Work stopped early this year when fire destroyed the mine's $50,000 mill. Some 100 tons of ore will be trucked daily to the ball mill and flotation plant at the Oxford mine, under lease to Best Mines. The company plans a 2,200-ft. tunnel to carry Bush Creek ore to cars by gravity, L. L. Huelsdonk, mgr., said.

Good values have shown in surface workings of the Liberty claims at Forest. Hugh and Philip O'Donnell are planning to install a ball mill at their leased Kate Hardy mine. Near the Kate Hardy, Best Mines has leased 18 claims.

The Tennessee placer property at Poker Flat near Downieville is being operated by Lawrence Nessler and associates. Formerly a rich producer, the mine was reopened last fall after 18 months inactivity.

World Lead Situation Appraised at Meeting

R. L. Wilcox, chief Non-Ferrous Metals Branch of the ECA, told members of the Lead Industries Association at the annual meeting in Chicago, April 13, that world consumption of lead in 1948 and 1949 failed to reach the level that obtained during the prewar or 1935-38 period. Consumption of primary lead during the 1935-38 period averaged 1,383,000 metric tons annually, as compared with 1,314,000 tons in 1948 and 1,147,000 metric tons in 1949.

"This indicated trend is directly opposite to that for practically all other non-ferrous metals," he said, "wherein significant gains over the 1935-38 average have been registered. This would indicate a definite loss of a substantial market by either outright elimination and/or increased substitution by other metals." He pointed out, however, that United States consumption had increased over this period, but that Western European consumption declined to more than offset the domestic increase.

A review of world statistics prompted these conclusions by Mr. Wilcox: 1. Existing world smelting capacity appears to be adequate to meet consumer demand for the next few years. 2. There will be a need for increased mine production if world smelter operations are to be increased much beyond current levels.

From a price standpoint, he doubted that a long-range market could be sustained at a price much below 11 to 15c. per pound in view of limited prospects for increasing mine production, and increasing costs of recovery.

K. W. Green, purchasing agent of Electric Storage Battery Co., told the association members that 505,300 tons of lead were in use in 1949 in auto batteries, and that in 1950 this amount was expected to increase to 536,400 tons.

Lloyd Hallam, assistant comptroller of Consolidated Mining & Smelting Co. of Canada, Ltd., reported that Canada will have to continue exporting the major portion of its lead production. Formerly, the United Kingdom had been the chief importer of Canadian lead, he explained, but now this picture is changing due to Britain's monetary difficulties, and U. S. is becoming a major outlet.

Miles M. Zoller, vicepresident of Eagle-Picher Sales Co., stated that in the face of titanium dioxide pigments, white lead should be able to hold its own, because, unlike titanium dioxide, lead pigments react chemically with paint oils to form lead soaps that give elasticity, plasticizing and aging properties to the paint.

Dr. Alex Stewart, director of research, National Lead Co., brought out a new concept of the properties of white lead in the paint industry. He stated that when a paint film begins to break down, chemical reactions take place resulting in the formation of such acids as formic and acetic as well as others of high molecular-weight. Lead combines with these acids, neutralizing their action and resulting in a more durable paint film. If these acids were permitted to remain, the film break-down would become very rapid.

The following officers were re-elected at the Lead Industries Association meeting held in Chicago on April 13-14: Felix E. Wormser, president; J. A. Martino, vice-president; K. C. Brownell, vice-president. R. L. Ziegfeld was reappointed secretary-treasurer.

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California *(Continued)*

★A number of placer properties are being worked in the Trinity River region.

In the Minersville area, **Fairview Placers** is using an improved bucket-line dredge, formerly operated by the **Junction City Mining Co.** Fairview management reported last year that the property contains some 20,000,000 cu. yd. of profitable gravel.

Installation of equipment was expected to be completed soon at the French Bar east of Del Loma. An access road has been extended to the property, controlled by **Oro Del Loma Mining Co.** The company plans to work the deposit with a 3-cu. yd. dredge bucket.

The dragline dredge which sank early this year at the Nash property on Coffee Creek near Trinity Center has been raised and dredging was expected to resume soon.

The Gilzean interests are working the Red Hill property in the Junction City field, using a bulldozer and hydraulic monitors. Several operators in the Trinity area are reportedly using bulldozers and tractors to clear overburden from deposits that could not be profitably operated in pioneer days.

★**U. S. Vanadium Corp.** and the International Union of Mine, Mill & Smelter Workers have completed negotiations on a contract providing for a 5c.-an-hour increase for workers

at the company's Pine Creek tungsten mine and mill. Employee contributions to the company group insurance program are reduced under the new contract, effective until July 9, 1952.

★**Francis Gage,** operating the Hi-Grade mine some 60 mi. from Los Angeles, reported that the shaft at the gold property has been deepened to 250 ft. The major vein is drifted along six tunnels. Gage and his partner, Floyd Arnold, are working the mine profitably with a four-man crew.

★J. D. Swift, president, told stockholders of **Central Eureka Mining Co.** that operations were to start soon on the 3,300-ft. level, where 10,000 tons of ore will "assay an ounce or better a ton." He reported that the cost of operating the mine was then $15 a ton, but that it was hoped it would be reduced in the near future.

★**Alhambra Gold Mining Corp.,** Hollywood, operating the Alhambra gold property at Kelsey, reports that the high-grade deposit discovered last fall in a drift on the 225-ft. level persisted to a depth of 40 ft. The company now plans to sink to the 350-ft. level, then explore below the present workings.

COLORADO

★**Crystal Hill Mining Co.,** in the La Garita district, has started operation of a new 300-ton ball bill. Mining operations include the Crystal Butte claim group and the old Buckhorn mine. Open-pit mining methods are used, according to John Hamm, manager. The mill is now treating about 100 tons of ore per day.

★Gold receipts at the Denver mint in March totaled 56,097 oz., worth $1,963,428, as compared with 47,853 oz. for March, 1949. Silver receipts totaled 14,201 oz., worth $12,549.

★**Callahan Zinc-Lead Co.** reports that tons milled at its Akron unit in Colorado totaled 14,656 tons in 1949 as compared with 18,158 tons in 1948. Decrease in grade from 28% combined lead and zinc in 1948 to 24.6% in 1949 was offset by improved recovery methods.

★**Climax Molybdenum Co.** produced the following products in addition to molybdenum during 1949: 215,000 lb. tungsten, 9,200 tons high-grade pyrite, 37,500 lb. tin. It expects to add monazite and topaz to its by-products list. Topaz is used in quick-setting cements. Known ore reserves will support the current mining rate of operations for more than a century, according to A. H. Bunker, president. A conservative estimate of present ore reserves is 250 million tons.

★**Beryllium Mining Co.** is producing various pegmatite minerals from its operations on Willow Creek in Gunnison County. Operations are centered chiefly on the Bucky claim from which about 18 tons of beryl have been shipped. In addition these oper-

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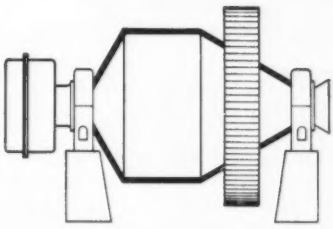
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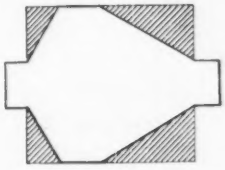
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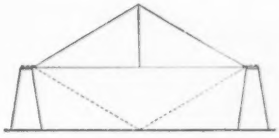
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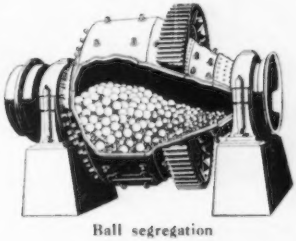
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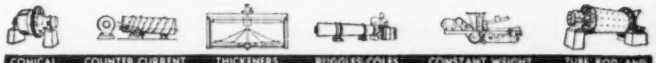

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Colorado *(Continued)*

ations have produced about 100 tons of scrap mica.

★**Cracker Jack Mining Co.**, of Nevada, has taken a lease and option on the Kittimac property in Minnie Gulch in the San Juan district.

★**American Zinc, Lead & Smelting Co.** reports that search for ores in the Ouray district has failed to disclose substantial tonnages of commercial ore. The development program has been materially reduced, but the custom mill will continue to operate.

★**The California mine** in the Lake City area under lease, has been a steady producer of ore averaging 12% lead, 5% zinc, and 8 oz. silver per ton since Dec. 1, 1949, according to lessees. The Garlock mine in the same area, also under lease, has shipped several loads of ore averaging 1.6 oz. gold, 20% lead, 15% zinc, and 25 oz. silver per ton.

★**Shenandoah-Dives Mining Co.** has issued its report for 1949. It reveals that high development cost, low base metal prices and low gold content in the ore prepared for production in 1949 brought the net smelter value below operating cost. To get a better grade of ore for 1950 the company has been developing the Melville vein.

★Thirteen bids for driving a 3,500-ft. extension of the Leadville drainage tunnel were received by John H. East, Jr., regional director of the Bureau of Mines. East said he will go to Washington to discuss the bids with Bureau of Mines officials. Last October, Congress authorized $500,000 to extend the tunnel which is designed to drain water from mines in the Leadville area. The Bureau called for competitive bids on specifications drawn by Bureau engineers but got no bids on its first try.

★An advisory board of contract appeals has been established by the U. S. Atomic Energy Commission to take care of appeals arising under the so-called "dispute clause" of the AEC contracts. This clause provides that contractors with the AEC may appeal the decisions of AEC contracting officers in disputes arising under the terms of contracts. The final decision on each appeal will be made by the general manager on the basis of recommendations submitted by members of the advisory board.

IDAHO

★**Sunshine Mining Co.** is starting extensive prospecting operations for uranium minerals in its deep workings, where Geiger counters indicate radioactivity in an area not connected with any of Sunshine's silver-copper-antimony or silver-lead ore deposits. Uranium indications were first found on the 3,100 and 3,700-ft. levels to such an extent as to encourage inves-

tigation of higher levels, where Geiger counters also indicate uranium minerals in the same zone. So the company is cleaning out a number of the old stopes to determine if the uranium minerals can be found in sufficient quantity to constitute a commercial deposit.

In reference to this project, Sunshine has the following to say in its annual report for 1949: "A Geiger counter survey of the Sunshine mine, which was undertaken last July in cooperation with the Atomic Energy Commission, disclosed a radioactive zone in close proximity to the north side of the Sunshine vein in the western part of the mine. Further investigation resulted in positive identification of the primary uranium mineral, pitchblende, in specimens and samples taken from this zone on both the 3,100 and 3,700-ft. levels. The pitchblende occurs as microscopically fine particles and does not respond to ordinary methods of concentration. On the basis of present information it appears doubtful whether the material could be mined and treated at a profit. However, a thorough program for exploration of the zone has been laid out and metallurgical test work on representative samples is in progress."

★**Sunshine Mining Co.** has recently purchased a large interest in the Texas-Calgary Oil Co., of Calgary, Canada.

★**Sullivan zinc plant,** at Kellogg, has been compelled to close down one of its four production units because of a shortage of zinc concentrates.

★**Lucky Friday Silver-Lead Mining Co.** is now sinking from the 1,600 to the 1,800-ft. level. The shaft was recently completed from the 1,400 to the 1,600-ft. level, where a crosscut was driven to the vein. Several stopes have been opened up and production started on the 1,600-ft. level.

★**Nabob Mining Co.,** on Pine Creek, has recently opened up a 16-in. width of high-grade lead-zinc ore in the west drift on the Crystolite vein in the lower Nabob tunnel. The ore is in a highly bleached Prichard quartzite in a wide mineralized zone showing a well defined footwall.

★**Sunshine Consolidated Mining Co.** has completed its 2,300-ft. crosscut to the Sun-Con vein from the 2,700-ft. level of the Sunshine mine, and opened a 3½-ft. width of ore that averages 40 oz. of silver per ton across the face, according to Norman Smith, engineer in charge of the work. The present crosscut will give the company four stoping levels.

★**Silver Syndicate Mining Co.** is crosscutting to the vein on the 3,850-ft. level from Sunshine mine workings. The crosscut will be about 300 ft. long, and if the ore proves as good as on the 3,700-ft. level, the company plans to sink a winze to explore the vein at greater depth.

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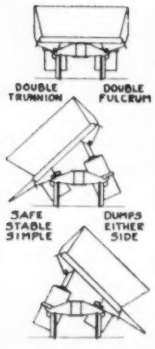

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Idaho *(Continued)*

deposit of lead-silver ore in unexplored territory on the hanging-wall side of the Cate fault. The vein was first found accidentally in driving a crosscut on the 17th mine level and has since been located on the 18th level, 200 ft. deeper. Where exposed and developed thus far the ore is not only in commercial quantity but is also of better average grade than the ores on the footwall side of the Cate fault, according to J. B. Haffner, manager.

★**Spokane-Idaho Mining Co.** reports a new record production of 830 tons of zinc concentrates and 190 tons of lead concentrates in March.

★Three locals of the International Union of Mine, Mill & Smelter Workers, Wallace, Kellogg and Mullan, which were recently expelled from the CIO, have rejected a proposal which would have merged the three locals into one central union. R. W. Hanson, international representative of the union, and Maurice Travis, international secretary-treasurer, sponsored the idea. The Wallace Union voted 95.2% for the proposed merger, Kellogg voted 557 to 459 against it, and Mullan voted 104 to 87 against.

★**Day Mines, Inc.**, has driven a tunnel westerly on the 1,000-ft. level in the old Hercules mine at Burke through the Hercules transverse fault and has opened commercial-grade silver-lead ore, and, according to the company's annual report, "this exploration is considered promising and is being pressed with all possible dispatch." Development of other areas in the mine have been discontinued because of high costs and low metal prices.

The company has completed sinking the main shaft on its Tamarack & Custer property to 3,000 ft.

★**Silver Dollar Mining Co.** has advanced its Purim crosscut on the 2,800-ft. level a distance of 2,100 ft. This is a prospecting operation to develop an unknown section of the Silver Belt east of the Sunshine mine.

IRON COUNTRY

★The skip pocket at **M. A. Hanna Co.'s** South Agnew mine has been lowered in preparation for the 1950 production season. Stripping at the company's Morton mine continues with a standard electric shovel and 30-ton trucks.

★**Inter-State Iron Co.** has three new 30-ton end-dump Mack trucks in operation at the Hill-Annex mine at Calumet. The boxes are heated from the engine exhaust to prevent sticking during freezing weather.

★**Minnesota Power & Light Co.** has completed a 110,000-v. transmission line from the Thomson hydroelectric station, near Duluth, to its Riverton substation on the Cuyuna.

★**Oliver Iron Mining Co.'s** new Fraser

underground mine is expected to ship this season. The new crushing and screening plant at the Sherman mine, to serve the Chisholm-Fraser district, is about completed.

★**Snyder Mining Co.**, with three operating mines on the Mesabi range, expects to ship about one million tons in 1950. About 300 people will be employed.

★At **Inter-State Iron Co.'s** Schley mine near Gilbert, a small crew of underground miners is at work cleaning out old shafts and drifts to aid in draining the Schley pit.

★The 1950 season will be the first for **Inter-State Iron Co.'s** Hill-Annex mine to operate under a lease direct from the state of Minnesota. Previously its lease was with the **Arthur Iron Mining Co.** (Great Northern Ore) which, in turn, leased from the state.

★As of April 1, the **M. A. Hanna** mines of the Menominee range have produced 385,373 tons since Jan. 1. The Wauseca mine lead the list, followed by Hiawatha No. 1 and No. 2, the Homer and the Bengal-Tully.

★A meeting of the Lake Superior Mines Safety Council was held at Ironwood April 6 with 137 attending. J. P. Victor, safety engineer for Castile Mining Co. of Ramsey, was in charge. Harry C. Swanson, mining engineer, Cleveland-Cliffs Iron Co., Ishpeming, gave a talk on "Safety In Sinking the Mather 'B' Shaft." An interesting paper, "Drifting into an Abandoned Mine" was given by Albert Beissel, Jr., ventilation engineer, Pickands, Mather & Co., Ironwood. There was also a panel discussion on "Safety in Handling Timber in Raises," led by B. L. Knudsen, superintendent, Castile Mining Co., Ramsey.

★**Oglebay Norton & Company's Castile Mining Co.** has transferred its lease to the Eureka mine at Ramsey to the **Youngstown Mines Corp.**, according to a report from Frank J. Smith, general superintendent for Oglebay Norton.

★The 17 men laid off at the **M. A. Hanna Co.'s** Homer mine were recalled following a return to former output standards by workers in the mine. After meeting with company officials, union heads agreed that a slow-down evidently had occurred in violation of the contract and that responsibility was on the workers.

★Fifty men of the Iron River district have been recruited by the **Anaconda Copper Mining Co.** for jobs in Anaconda's Butte mines. Their representative also spent two weeks in the Michigan copper country taking on unemployed copper miners. Anaconda plans to secure about 500 men for work in Butte mines now operating and in developing the Greater Butte Project.

★Most of the iron mines of Iron County, Menominee range, began load-

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Iron Country *(Continued)*

ing ore into railroad cars during the last two weeks of April and some ore was moved to Escanaba. Stockpiles, also, are being loaded out. A severe snow storm during the last few days of April further delayed an already late opening of navigation.

★The Bristol mine at Crystal Falls, which was closed for 17 years, has resumed shipping. **Inland Steel Co.** began dewatering the mine two years ago. Inland has leased the adjoining Youngstown mine from the **Oliver Iron Mining Co.** and will operate it through the Bristol shaft.

★Ed. H. Anderson, superintendent of **Republic Steel Corp.'s** Tobin mine at Crystal Falls announced that the mine would operate on a five day per week basis instead of four. The Tobin employs 185 men. Inland's Sherwood and Bristol mines are also working a five-day week.

★Opening of navigation at the Duluth-Superior harbor in 1950 has been unique. In the first place, it was opened "in reverse." Always, in preceding years, the first ore carrier to arrive from lower lake ports for a load of iron ore, was heralded as having officially opened the shipping season and was recognized and honored therefor.

This year, the sturdy icebreaker, Mackinaw, was the first arrival. She fought her way through windrowed ice, often piled higher than 25 ft., from Soo to Marquette, and through solid ice, 18 to 24 in. thick, from Two Harbors to Duluth.

First ore carriers to leave the harbor, instead of being heavily loaded with iron ore, went out without a single ton. They required the assistance of the Mackinaw in reaching Two Harbors where they received their first cargoes.

Now, with the departure of seven freighters that wintered in the Duluth-Superior harbor, the question is being debated as to whether or not the 1950 season has been officially opened as far as Duluth and Superior are concerned.

Incidentally, April shipments from Upper Lake ports totaled 348,804 tons as compared with 8,868,286 tons in 1949, a decrease of 96.18%

MICHIGAN

★The United Steelworkers of America, CIO, were chosen as the bargaining representative for employees of **Calumet & Hecla Consolidated Copper Co.** in a runoff election conducted April 27 by the National Labor Relations Board. The Steelworkers polled a total of 908 votes to 869 for Local 584, International Mine, Mill and Smelter Workers, which had been the bargaining agent for the employees since 1941.

★According to A. O. Rockwell, assis-

tant general manager of Calumet & Hecla, underground operations are concentrating on an all-out effort to improve the grade of ore being mined. To bring this about, certain rules for miners to follow have been put into effect. The average pounds of copper per ton of ore stamped in 1949 was 18.63 for all mines and for the first three months of 1950 the average was 18.65. In order that the mines might break even, the grade of ore must be increased to about 20 lb. per ton, Mr. Rockwell says. Even at the present price of copper, the mines, he states, are losing money and it is imperative that every effort be made to improve the grade. New openings in Centennial, North Kearsarge, Peninsula, Seneca, Iroquois, and Allouez are in commercial ground.

"While the increase of one cent in the price of copper will help underground operations at Calumet & Hecla, it will by no means eliminate all of its problems," said A. H. Wohlrab, vice president and general manager. "A further increase in the market price, plus a restoration of the tariff on foreign copper, or some other form of assistance, is needed to place mining operations on a break-even basis."

At the Shullsburg, Wis., lead and zinc property of Calumet & Hecla, water continues to be a problem and additional pumping capacity is being prepared. The drilling of an 18-in. diameter hole from surface to sump has been started and when completed will make possible the use of an additional 2,000-gpm pump. A second loading unit and truck have been taken underground.

MONTANA

★**Montana Rainbow Mining Co.**, Marysville, Lewis & Clark County, reports that its gold milling plant was completely destroyed by fire on April 3, with a loss of over $300,000, not fully covered by insurance. The company is a co-partnership consisting of W. R. Wade and B. Mae Anduizia of Marysville and Richard Rheem, Rheem Manufacturing Co., San Francisco. Managing partner Wade stated that the plans of the company for the future are indefinite.

NEVADA

★Davis Budd, Palmdale, Calif., contractor, has moved equipment onto the Stemeyer property at Round Mountain in Nye County, and plans to mill 50 tons of ore daily this summer. Gold occurs in small, reasonably loose quartz stringers in the shale, and is said to assay $4 to $5 as it stands.

★**Boyles Bros.**, Salt Lake City diamond drillers, have spudded in the first hole north of Tonopah. They are under contract with the American

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The fast, light blows of these drills are just right for carbide bits. This and a steady, cushioning, positive air feed that automatically compensates for variations in the rock give you increased drilling speed — from a machine that is 70 pounds lighter than the average power-feed drifter.

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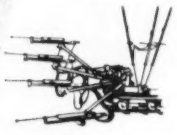

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Nevada *(Continued)*

Smelting & Refining Co. to put down a series of holes in the big acreage formerly explored by **Calumet & Hecla Copper Co.**

★O. E. Walling, Wayne Hawkins and Robert Borneman, of Los Angeles, have acquired the Yellow Gold mine, 27 mi. north of Beatty, known as the Curly Carr property.

Mr. Carr has done considerable work on the ground and has a favorable showing of gold ore.

★G. A. Peterson, who operates a property in the Candelaria district, 25 mi. south of Mina in Mineral County, is making regular shipments of silver, gold, lead and antimony ore this spring. The vein averages from 1 to 8 ft. Gold and silver values are running fairly high, and lead content does not average more than 10%. C. A. Wethern, of the Mina, has taken a lease from Peterson on the same ground and the two men are also contemplating an operation at the old camp of Douglas in the near future.

★K. Dunham is starting construction of a mill at his tungsten property in Nye County, 24 mi. east of Mina. The site was surveyed early in April, and a well on the property was put in shape for installation of a pump.

★A trial run was made early in April by officials of the **Little America Mining Co.** at their placer plant in Limerick Canyon, Pershing County, and everything was found to be satisfactory. Their greatest hazard, clay, did not appear to be interfering with operations.

★Nevada's first underground mine accident fatality in two years occurred on April 13, when Arvel Stephens, 37, was killed near Pioche, in Lincoln County. Mr. Stephens, an independent leaser, died when the shaft in which he was working caved.

★Nine men are steadily employed this spring by J. Irving Crowell on his fluorspar property near Beatty in Nye County. Shipments of ore, while irregular, continue at a fairly level monthly average.

★Annual report of **Getchell Mine, Inc.**, on its property in Humboldt County, was released during April and shows a net operating profit of $188,514 during 1949. A total of 151,695.5 dry tons were milled during the year, producing 18,758.51 oz. Au of gold and 1,999.76 oz. Ag of silver, having a gross value of $656,038.

★Working 24 hours per day and processing about 30 tons daily, the mill and other operations at the Alabama mine in the Awakening district of Humboldt County are now employing 17 men. The report was made at a director's meeting of the **El Dorado Gold Mine Co.** in Winnemucca.

★A 10-ton Spokane ball mill and concentration table have been installed by the **Black Star Development Co.** at

its gold property at Trego, in Pershing County. Free gold will be taken off and a telluride concentrate shipped.

★W. P. Smith, of San Francisco, secretary and principal owner of the **Victory Divide Mining Co.**, recently announced that this company had purchased the Belmont mine at Tonopah.

NEW MEXICO

★Development of light weight aggregates—pumice and perlite—continues to accelerate in New Mexico. One of the biggest items is announcement that New Mexico pumice will be used in building an 800-home housing project at Biggs AF Base, El Paso, Tex.

An estimated 3,000 tons of perlite rock is being produced in New Mexico monthly. Largest operator is **Great Lakes Carbon Co.** with quarries at Socorro. **Edgar D. Otto & Son,** manufacturers of pumice and cinder blocks, at Albuquerque, have built a new type furnace for burning pumice and expect to market a pumice product comparable to expanded perlite for plaster aggregate, and possibly manufacture the furnaces for sale.

★After 10 months of relative inactivity, the miners are going back to work in Grant County at the copper, lead and zinc mines. Two-thirds of the 1,500 idle miners have been rehired. **Kennecott Copper** has been working 6 days a week since January. **American Smelting & Refining** and **United States Smelting, Refining and Mining Co.** are preparing to get into production again after shut-downs.

★**Duval Sulphur & Potash Co.**, new operator in the Carlsbad potash district, is working at its initial shaft. There will be two 1,500-ft. shafts costing about $1,000,000, according to W. Page Morris, general superintendent.

International Minerals & Chemical Corp. announced in April, through Nelson White, assistant manager, that it will spend $1,500,000 in the next two years on a connecting shaft to be used for transportation.

Potash Company of America at Carlsbad will soon be completing some items of its present expansion program: grinding mill extension, new compressor building and new refinery control laboratory. The new research building was reported on in last months's issue of E&MJ.

All three of the operating potash companies report expansion of working forces and peak production, catching up after the 73-day strike of last winter.

NORTH CAROLINA

★After an extensive survey, the Army Corps of Engineers has announced approval of a project calling for adding a dam (estimated cost: $1,000,000) to the Buggs Island Roanoke River hydroelectric and flood con-

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North Carolina *(Continued)*

trol project in Vance County to prevent flooding of what is considered the world's largest tungsten deposit owned in part by the **Tungsten Mining Corp.**

The dam to be an earth dike 90 ft. high, will cross Island Creek in northern Vance County, and was approved after a six months' survey. Lunsford Long, vice president and general counsel of the mining firm, said part of the cost of pumping water to keep the mine from being flooded would be borne by the company.

OREGON

★**Dant & Russell,** operator of the Lady Frances perlite mine, is producing 14,000 12x12-in. acoustic tile per 8-hr. shift at its new plant at Frieda. This new "Dantone" product is being shipped generally to the western trade.

★Smithwick Concrete Products has placed in operation its new plant at Portland for the manufacture of Haydite lightweight aggregate from shale brought from the company's quarry at Vernonia, 40 mi. west of Portland. Daily capacity is 300 cu. yd. of the product. Raw shale is heated at 2,200 deg. F. in a rotary kiln 8 ft. in diameter and 100 ft. long, largest in the shale expanding industry. The finished cellular product has a density of only 44 lb. per cu. ft.

★It was reported from Portland that one group of farmer suits against the **Reynolds Metals Co.** because of fume damage from the Longview and Troutdale plants had been settled out of court April 24, but another suit was set for trial on the 25th. The settlement was said to cover claims of 17 Troutdale and seven Ranier area farmers but terms were not made public.

TRI-STATE

★Miners' wages are going up in the Tri-State district, along with the price of zinc. Union contracts call for increases in pay for any increase in the price of zinc above 10½c.

★Dave Winston and John McIntyre are opening the Dodson mine 2 mi. east of Picher, Okla. There is a 6x6-ft. shaft down to the orebody at the 206-ft. level. Ore faces there carry from 5% to 10% zinc and lead ore which previous owners mined extensively. The present lessees will work the 206-ft. level and another orebody at about 160 ft. Drill logs of the shallower orebody show an average of 6% blende.

★**Federal Mining & Smelting Co.** has placed five drill rigs on leases and land recently bought from George Potter.

★The **Kenyon & Co.** mines, 4 mi. southwest of Dadesville, has struck a

galena orebody. The mines formerly produced calamine near the surface. The lead ore is at some depth and a shaft has been sunk to 70 ft. with a clamshell bucket.

★T. Spencer Shore, president, and J. N. Bowlbey, chairman of the board of **Eagle-Picher Co.** recently made a tour of inspection of the company's mines in the Tri-State. Both were very optimistic regarding the future for zinc and the life of the Tri-State mines. They stated that they believed the price of zinc concentrates would rise to $75 per ton.

UTAH

★New interest has developed in the rapidly growing uranium field near Marysvale, Utah, with word that uraninite has been found in sizeable quantity in two mines, along with strong indications of pitchblende.

When **Vanadium Corporation of America** and the **Bullion Monarch Mining Co.** began operations near Marysvale nearly a year ago, the ore found in the district was of the autunite-torbernite variety. In March the AEC, noting the ore could not be treated by standard processing at its Monticello, Utah, plant, established a purchase depot at Marysvale to provide a market for development ore, and stated a processing plant would be built if the situation justified construction costs.

A new factor developed in the situation in mid-April when the Vanadium Corporation of America disclosed that uraninite, a primary form of uranium, had been discovered in its incline shaft mines. Samples shipped to the AEC depot were reported to run 12% uranium oxide.

A few days later, it was reliably reported that VCA miners under the supervision of engineer Rex Smith found specimens of a black ore 30 ft. beyond the original uraninite find. The black ore, seemingly pitchblende, "is somewhat softer and lacks the luster of Canadian pitch-blende" but registers violently on Geiger counters.

Almost simultaneously, R. N. Cooper, treasurer of Bullion Monarch, which operates an open pit in the autunite area less than ¼ mi. from the VCA shafts, reported "there is evidence to indicate we are approaching pitchblende formations at Marysvale." Cooper cited assays indicating recent Bullion Monarch shipments to the AEC depot are running above the average highgrade formerly noted in the district's autunite mines.

WASHINGTON

★**Mines Management Corp.**'s Iroquois operations in Stevens County are reported to have developed from the prospect stage to a mine within a nine-month period. Tests by Cy Garber and Frank McKinley of Kellogg,

QUINCY MINING COMPANY

Saves 657,165 lbs. of Grinding Balls with

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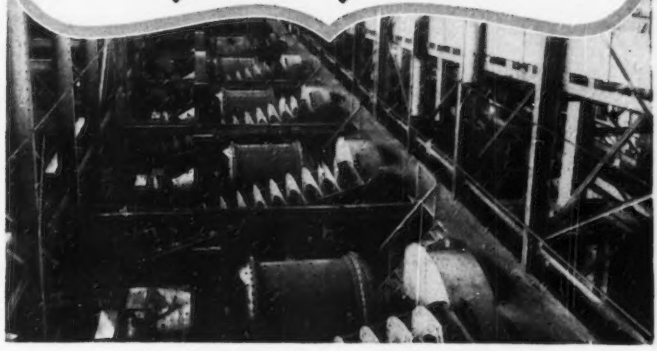
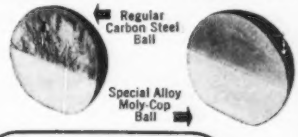
COPPER-MOLYBDENUM-ALLOY Grinding Balls



Quincy Mining Company's six 8 ft. x 6 ft. Hardinge Ball Mills on Torch Lake, Hancock, Mich.

Based on a 9 month test period ending June 30, 1949, the consumption of Sheffield Moly-Cop Balls was less than ⅓ as much as forged steel balls previously used by Quincy Mining Company in the six mills shown above. The forged steel balls were consumed at the rate of 1.55 pounds per ton of ore ground as against .49 lbs. of Sheffield Moly-Cop balls.



Actual cash savings were more than $30,000 in nine months, despite the original higher per-ton cost of Moly-Cop balls. The economy of Moly-Cop Balls has been proved in mining operations all over the world.

The harder martensitic structure of Moly-Cop Grinding Balls, their toughness right to the core, are the reasons for this longer grinding life and grinding economy. Your own ore-reduction costs can be reduced considerably, when you charge your mills with Moly-Cop Grinding Balls.

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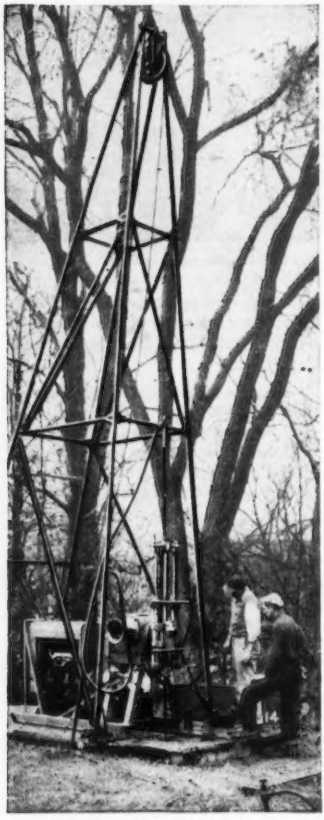

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Washington *(Continued)*

Idaho, and by the U. S. Bureau of Mines laboratory at Albany, Ore., are said to show that treatment by the sink-float method will collect about 90% of the metals. From flotation tests with 3,500 tons of ore at **Goldfield Consolidated Mining Co.'s** Sierra zinc mill, near Leadpoint, indications are that the company can make better than a 60% grade of zinc concentrate. An exploration and ventilation raise has been driven about 275 ft. and is expected to reach the surface with about 55 additional ft. Blocked-out ore reserves are reported to warrant production on a 300-ton per day scale.

★**Columbia Gypsum Products, Inc.,** was to start production of gypsum at its Greenacres plant, east of Spokane, early in May, according to Loren Brown, of Bremerton, president.

★The annual Pacific Northwest meeting of AIME, Industrial Mineral section, convened in Seattle on April 6, with Lee A. Heinzinger, of **Bethlehem Pacific Coast Steel Co.,** acting as chairman. The significance of valuable non-metallic industrial minerals to the economy of the industry in the Northwest was discussed.

★Films obtained from the U. S. Bureau of Mines by Norman L. Wimmler, supervising engineer of the Bureau's Spokane office, will be shown at Northwest Mining Association's weekly luncheon meetings.

★The $1-million sulphuric acid plant started operations at the Tacoma smelter on April 10.

★Washington's output of gold in February was 7,700 oz. and its silver amounted to 32,000 oz. in the same month, according to the U. S. Bureau of Mines' report.

★**Northwest Magnesite Co.'s** dust precipitator being added to the plant at Chewelah will have a 180-ft. chimney. This will be built in about 45 days this spring by Rust Engineering Co., of Pittsburgh, according to Howard Ziebell, general manager of the magnesite plant.

★Bellingham's Olympic Portland Cement Co. was forced to close May 1, for an indefinite peroid, due to lack of markets.

WYOMING

★Atomic Energy Commission representatives from Denver are investigating the uranium deposits reported at Sundance, Wyo., and in the Bear Lodge country. They will report to the New York office of the AEC results of the test. Samples taken by A. J. Katches, Duluth, Minnesota mining engineer and discoverer of this low-grade uranium showed the deposit also contained rare earth oxides. Katches made the strike while he was investigating fluorite deposits for a Duluth firm at the time.

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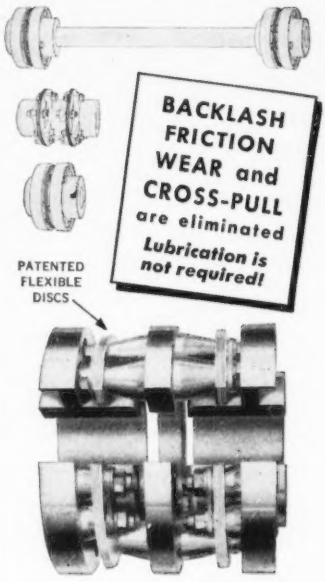

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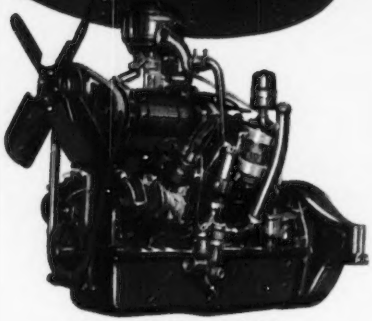

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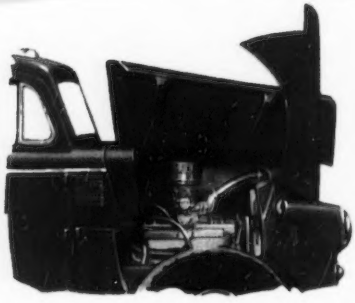

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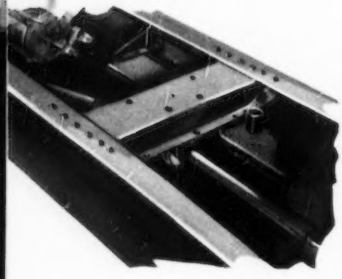

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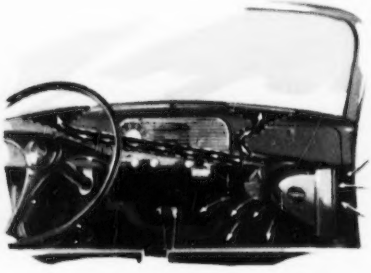

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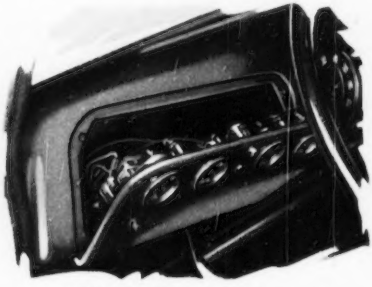


ACCESSIBLE WIRING PANEL

Electrical wiring under cowl is readily exposed by opening a door in instrument panel. Wires are colored for easy tracing of circuits.

FEDERAL TRUCKS

IN CANADA

• Dominion Boosts Uranium Price

• Falconbridge Reserves at New High

★Bolstering the spirits of all uranium prospectors, and raising hopes that new sources of the atomic element will be developed, the Canadian government has raised the price of uranium oxide and extended the guarantee period till March 31st, 1958.

Formerly $2.75 per lb., the price is now on a sliding scale that varies inversely as the grade of ore. **Eldorado Mining and Refining,** Canada's government-owned—and only—uranium producer, will buy uranium oxide in ores or concentrates; payment to range from $6 per lb. when the ore averages 0.25%, to $4.18 per lb. when the average grade is 2%.

Prospectors have ranged far and wide across the northern part of Canada during the past three years in search of uranium, and two fairly promising new fields have been found; one in Northern Saskatchewan, and one on the east shore of Lake Superior in Ontario. On the whole, however, the results of the search have been disappointing. The price-raise, accordingly, has given new impetus to the search and new encouragement to those who already have discoveries to develop.

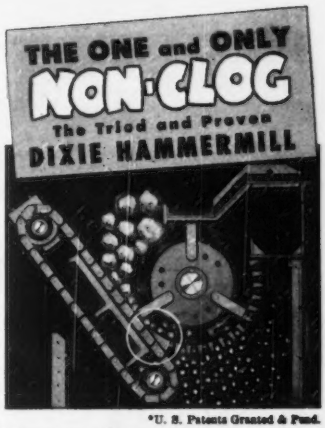
MANITOBA

★**Hudson Bay Mining and Smelting Co. Ltd.,** reports that ore reserves at the end of 1949 amounted to 20,157,000 tons, averaging 0.084 oz. in gold, 1.14 oz. in silver, 3.04% copper and 4.34% zinc. The zinc plant residue stockpile totalled 830,000 tons, averaging .0151 oz. gold, 3.96 oz. silver, 1.13% copper, and 26.6% zinc. The fuming plant will treat 109,500 tons of residue each year, but 51,000 tons of residue will be produced from concurrent operations, and it is estimated the present stockpile will contain 14 years' supply.

At the Schist Lake mine the surface plant is completed. No additional underground development work was done during the year and an estimated 270,000 tons of proven ore at this mine is included in the company's ore reserve.

At the Cuprus Mine production amounted to 21,182 tons of copper concentrates, averaging 13.09% copper, 2.29 oz. silver, 0.095 oz. gold; and 8,357 tons of zinc concentrates, averaging 45.4% zinc, 0.96% copper, 1.05 oz. silver and 0.025 oz. gold per ton. Ore reserves at the Cuprus property at the year end amounted to 245,000 tons, averaging 6.8% zinc, 3.62% copper, 0.91 oz. silver and 0.045 oz. gold.

★**Sherritt Gordon Mines Ltd.** in its annual report for 1949 revealed that 2,000,000 tons have been added to the ore reserves at the Lynn Lake property, the year end ore reserves totaling 10,365,000 tons, averaging 1.443% nickel and 0.681% copper. Metallurgical developments indicate the power requirements for the Lynn Lake operation could be reduced considerably and that an initial development will be located on the Laurie River having an installed capacity of 7,000 hp., ample to take care of the power requirements of a 2,000 ton per day milling and mining operation. Production for 1949 from the Sherridon operation was 432,524 tons milled, which yielded 18,959,270 lbs. of copper, 10,128 tons of 50% zinc concentrates, 5,247 oz. gold, 172,317 oz. silver. Total value of production amounted to $4,593,403.78. Production should continue throughout 1950 on a scale approximately 20% below that of 1949. The life of the West mine at Sherridon will probably extend into



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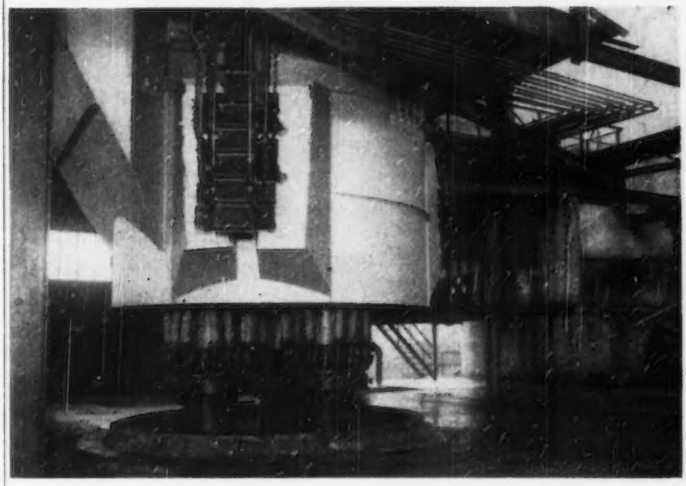

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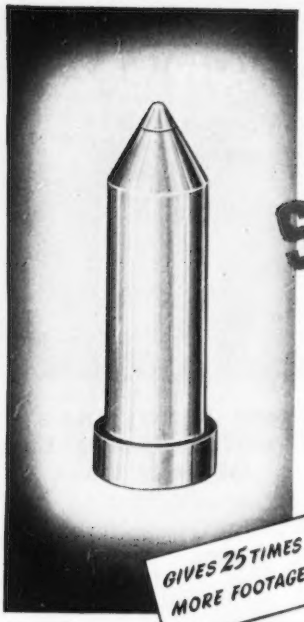

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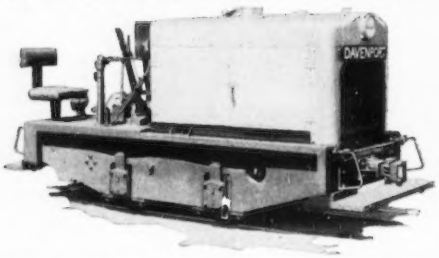

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Manitoba *(Continued)*

the first quarter of 1951. The East mine plant and buildings will be dismantled and shipped to Lynn Lake where it will become the permanent plant at the EL shaft.

★**God's Lake Gold Mines Ltd.** in its annual report states that the Lynn Lake claims are retained and the extensive work required for development has been deferred. The Oxford Lake claims are to be kept in good standing. Diamond drilling is planned for the ground held in the Island Lake area.

★**San Antonio Gold Mines Ltd.** reports production for the first eight weeks of 1950 amounted to $329,886 from the treatment of 29,598 tons, averaging $11.05 per ton. For the corresponding period of 1949 production was $262,936 from 28,230 tons, averaging $9.31 per ton.

★**Squall Lake Mines Ltd.** reports that no underground operations will be carried out this year on its holdings at McLeod Lake in the Herb Lake mining division. The holdings, comprising 67 claims, have been leased for 21 years.

★**Berens River Mines Ltd.** reports that diamond drilling at the Sourdough Bay option proved disappointing. Four holes on the main zone returned assays of less than 1% copper, while one hole yielded low value in zinc. Three other anomalies were tested without significant results. Work has been suspended until next winter.

QUEBEC

★Slicing a fat $1.2 million off the demand loans which financed the mine to production, **Quemont Mining Corporation** earned 56c. per share in the first quarter of 1950. Loans close to $6.9 million had been required, but the management now hopes that they can be wiped off the books entirely before the end of 1951.

One of the post-war diamond drilling sensations, Quemont started production in June of last year with a daily milling rate of 2,000 tons, and enough ore to last for 13 years. Although little development work was done in the remainder of the period, known reserves were even higher at the start of 1950. Now, with production kinks straightened out, and operations well entrenched on the credit side of the ledger, an intensive program of development is under way at the big copper-gold mine.

★Ore reserves of **Lamaque Gold Mines** at the end of 1949 were the second-highest in its history, although tonnage milled last year made a new record at 504,350 tons. Reserves stood at 2.5 million tons averaging 0.215 oz. gold. The depth development picture at the expanding Bourlamaque Twp.

mine has never been brighter, and a four-compartment winze is being started from the 2,400-ft. level. Big widths of ore are not unusual at the mine, but the No. 27 vein will show stoping widths up to 100 ft. in one section between the 2,200 and 2,400-ft. levels.

Work is also making good progress at the Louvicourt Twp. property of Lamaque's subsidiary, **Beacon Mining Co.**, where underground work was resumed late last year after a two-year closure. If results are as good as the original drilling, the Beacon could soon be shining brightly.

★Grinding 1,706 tons daily for a new record, **Malartic Gold Fields** in the first quarter of 1950 had gold production of more than $1 million, and operating profits of $307,434, more than double those of the corresponding period of 1949. Yet earnings last year were the highest on record at 18.8c per share, enabling the company to pay off its $890,000 bank loan and end the year with a strong cash position. Ore reserves at the end of 1949 stood at 4,875,000 tons, a total exceeded by only two other Canadian gold mines, Hollinger and Kerr-Addison.

Plans are now in hand for deepening the No. 2 shaft, and news can be expected this summer from the south contact of the greenstone, toward which a long crosscut is progressing on the 1,050-ft. level. Good indications were had there in surface drilling away back before the war, but the area has since been neglected while the present mine was developed near the north contact.

★On the other hand, **East Malartic Mines**, next door to Gold Fields, is starting to explore the north contact, its hopes aroused by Barnat Mines' success in that section still farther west. (Gold Fields, East, and Barnat, it will be recalled, are all in line astride the Malartic area's greenstone band.)

Oddly enough, East Malartic's first underground work was done in the north section, but both shafts there were closed twelve years ago when the big medium grade orebody was discovered along the south contact. The north zone has never been forgotten, but in recent years the company has lacked the time and funds for property-wide development. In 1949, however, black ink replaced red as the mine made new records in tonnage milled and gold produced, at the same time adding 500,000 tons to ore reserves and doubling the company's working capital. Now, with the mine successfully re-established, managerial thoughts have again turned toward the north, and diamond drilling is in progress.

★Although copper output was upped by 3.3 million lbs. last year, and zinc by 3.8 million lbs., net profits of **Normetal Mining Corporation** were down from 41.4c to 36.2c per share. Lower metal prices accounted for the

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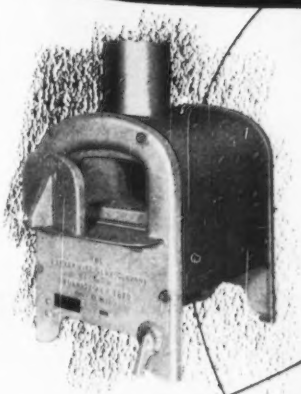

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Quebec (*Continued*)

difference. Exploration is now starting on the new block of ground made available by the deepening of the No. 4 internal shaft from the 3,240 to the 4,160-ft. level last year.

ONTARIO

★**Newlund Mines,** opening the 200-ft. level at its property in the Sioux Lookout area, is making good headway toward the establishment of the first mine to be developed in this corner of the province in many years. Controlled and financed by **Anglo-Huronian,** the company was formed late last year as a reorganization of **Lunward Gold Mines,** shareholders receiving one new for two old shares, and also one share of **Warlund Mines,** formed to acquire the remaining Lunward assets apart from the property. Newlund's success has brought its neighbors into activity, and exploration has been started, or is planned, by **Villbona Gold Mines, East Lun Mines, Conecho Mines,** and a number of syndicates.

★Another sleeper that's being awakened is **Osulake Mines,** which ran out of money three years ago before fully developing its property at O'Sullivan Lake, north of steel at Cavell in the Thunder Bay division. A new company, **Lake-Osu Mines,** is being formed, and exploration should be in full swing by the middle of the summer.

★Mill plans are taking shape at the East Kirkland Lake property of **Queenston Mines,** where underground development was resumed early in the year. Preliminary mill plans call for a 500-ton plant, designed for easy expansion to 1,000 tons. With close to a million tons of ore averaging $7.70 —all between the Nos. 2 and 3 shafts areas, and all above the 400-ft. level— the mine seems to be headed toward profitable gold production sometime in 1951.

★Eight new levels will be opened at **Delnite's Mines'** property in Porcupine from a winze to be sunk this year from the 2,875-ft. level to the 3,900-ft. horizon. Total cost of the program will be close to $500,000.

★Ore reserves of **Falconbridge Nickel** reached a new all-time high at the end of 1949, rising to 14.8 million tons; an amount sufficient for 16 years' milling at the 1949 rate, which was also a new high at 940,930 tons.

Net profits were slightly down at 42.5c per share, compared with the 44.5c earned in 1948, but the difference was more than accounted for by an increase of $96,733 in depreciation charges. Falconbridge, incidentally, will benefit substantially from devaluation, as a large part of its sales are now made in the United States. Last year, of course, this benefit was felt only in the final quarter.

★With exceptionally fine ore disclosed on four levels in recent months, **New Dickenson Mines** is getting into line for good profits at its Red Lake mine. The mill is being doubled in capacity to 200 tons, and a roaster is also being installed. The equipment for expansion was bought from **Berens River,** which closed its mine last year, and which has taken New Dickenson stock in payment.

The most extensive showing of the new ore is on the second level, where most work has been done. At this horizon more than 800 ft. of 0.5-oz. ore has been opened in drifting, with average width of seven ft. More than 650 ft. of ground lies ahead on strike before the **Campbell Red Lake** boundary is reached. The latter company, it may be pointed out, is already mining what appears to be the same zone, with production of more than $600,000 in the first quarter.

★Dividends from **Lamaque Gold** are now the main source of revenue for **The Teck-Hughes Gold Mines.** Teck holds 80.7% of Lamaque stock and dividends on this made up two-thirds of Teck's 1949 profit.

After 32 years of production, and 25 years of continuous dividends, the original Teck mine at Kirkland Lake is wavering. Under present conditions the management doesn't feel sure of profitable operation there past 1952.

BRITISH COLUMBIA

★Exploration and prospecting by helicopter will be undertaken in central and northern British Columbia this year by a newly-formed syndicate, **Helicopter Explorations Co.,** headed by Karl J. Springer. Geiger counters and other mineral-detecting equipment will be mounted on the aircraft in exploration of normally inaccessible areas, and prospectors will be landed near promising formations detected by the airborne instruments. The company has obtained one helicopter and five prospectors for the work, which is estimated at $150,000 for 1950.

★Hardrock miners at Copper Mountain, Allenby and Princeton will get eight statutory holidays, with pay retroactive to Nov. 5, 1949, instead of the ten asked, in an agreement worked out by a three-man conciliation board and accepted by both International Union of Mine, Mill & Smelter Workers and **Granby Consolidated Mining & Smelting Co.**

★Bluebell Mine, on the east shore of Kootenay Lake, with offices at Riondel, will be equipped for production by the owning company, **Consolidated Mining & Smelting Co.** Initial mill capacity will be 500 tons daily. Lead and zinc concentrates will be shipped to Trail smelter.

★**Alpine Mining Co.,** which reported silver mining operations at its Noonday mine in the Slocan district hampered by severe weather and disrup-

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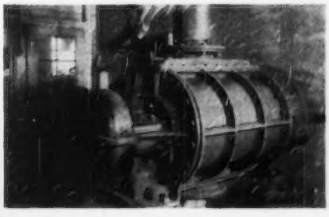

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British Columbia *(Continued)*

tion of transportation, is also resuming shipments to the smelter.

★Ore below the general average resulted in lower production by **Island Mountain Mines Co.**, Ltd., Cariboo district, in March, with output of 1,443 fine oz. valued at $55,560 from 3,905 tons, a gold recovery of 0.37 oz. per ton.

★**Silbak-Premier** mine, near Stewart, Portland Canal, has operated at a profit this year for the first time in seven years and has discovered promising indications of an extension of the orebody.

★**Cariboo Gold Quartz** is nearing completion of its program of deepening the shaft an additional 300 ft. in high-grade limestone replacement ore.

★**Guichon Mine Ltd.**, has discovered two new veins at its Copperado Mine, Nicola Valley, in its shaft sinking program to develop a high-grade vein. The original vein raked away from the shaft; the two new ones came into it, one being a high-grade vein 20 to 24 in. wide and increasing by 6 in. in the sump below the 200 ft. level.

★**The Highland Silver property**, adjoining the productive Highland-Bell mine at Beaverdell, near Grand Forks, has been purchased for $1,000,000 under an option agreement, by **Cranberry Creek Mining Co.**

★Construction has started on **Highland-Bell Ltd.'s** $100,000, 50-ton ball mill immediately south of the CPR depot at Beaverdell, on the east side of the existing track, and is expected to be in operation by August 1.

★**Congress Gold Mine**, Bridge River, has completed its dewatering program and has commenced driving of a 175-ft. crosscut on the fifth level, which is expected to pick up downward extension of a promising 7-ft. vein. Previously the vein was intersected on the third level, 225 ft. vertically above the present position on the fifth.

★**Vananda Mines (1948) Ltd.**, Texada gold-copper producer, backed jointly by **Sheep Creek Gold** and **Pioneer Gold Mines Ltd.**, of B. C., has appointed W. B. Tobey, mining engineer, as manager. Proceeds from shipment of about 2,000 tons monthly from development faces are expected to more than cover cost of proving up tonnage for resumption of milling in the good-grade orebody located last season between the fifth and sixth levels.

★**Consolidated Mining & Smelting Co.** is reported considering construction of a large ore smelter in the Edmonton area to treat mineral deposits from the Great Slave Lake and Yellowknife areas of the Northwest Territories. The project hinges on activities near Pine Point, NWT,

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where engineers are preparing to sink a 350-ft. shaft to prove up a zinc-lead orebody believed to lie along the shore of Great Slave Lake, about 540 mi. north of Edmonton. Consolidated and three other large Canadian mining companies are spending $1,000,000 developing and exploring 6,000 sq. mi. in the Pine Point area this year. If large orebodies were proved up, a 400-mi. railroad would have to be built from Peace River, Alta., to bring it out.

★Installation of a new $365,000 Oslo crystallizer in **Consolidated Mining & Smelting Co.'s** ammonium sulphate plant at Trail, is due to start immediately, bringing to five the number of units in the plant.

★Production of **Bralorne Mines Ltd.**, during the first quarter of 1950 was 22,522 oz. of gold valued at $882,097 from 50,339 tons of ore, averaging 0.447 oz. gold per ton. This was better than in any quarter since 1941.

★Bralorne has postponed its projected 20-level drive toward the adjoining **Taylor (Bridge River) Mines Ltd.** property, which it controls, because of a shortage of manpower, and in particular drift miners.

★**Silver Standard Mines Ltd.**, New Hazelton, set a new production peak in March, handling 2,700 tons, 764 tons being discarded as waste. The 1,936 tons milled, an average of 64.5 tons daily, averaged 0.12 oz. gold, 37.6 oz. silver, 3.05% lead, 7.9% zinc and 0.097% cadmium, or $62.60 per ton. Estimated gross value of 357.7 dry tons of concentrate produced was $125,000.

★**Torbrit Silver Mines**, Alice Arm, reports a net profit of $253,674 in its annual report for 1949. Ore reserves were increased by 55,521 tons over 1948 to 700,521. Silver content was up 1.4 oz. to 20.7 oz. per ton.

★Eastern interests which have optioned the properties of **Big Four Silver Mines Ltd.**, Portland Canal, plan to proceed to full operation as soon as possible if their engineers report favorably. A crew is preparing the workings for examination. Big Four is stated to have 120,000 tons of commercial ore accessible from present workings, but only a small part of the ground has been developed.

★First shipment of gypsum rock from **Columbia Gypsum Products, Inc.**, mine near Windermere has been made to the calcining plant at Spokane where it will be converted into soil conditioner and building products.

★An increase of 34.2% in copper output in 1949 is reported by **Granby Consolidated Mining, Smelting & Power Co.**, with production of 35,694,000 lb. compared to 26,593,000 in 1948, according to the annual report.

Tonnage shipped was 1,806,777, compared with 1,705,780 and copper content was 1.2% average, against 0.976%.

Value of copper output was $6,908,766, compared with $6,003,679 in 1948. Net profit after all deductions was $849,238 compared with $727,398.

Despite the extraction of 1,803,916 tons during 1949, ore reserves at the end of the year were about the same, the estimate being 7,524,000. Average grade is reported between 1 and 1.1%. Broken ore reserves at Dec. 31 were estimated at 1,611,000 tons.

★First gold dredge to operate in Omineca placer field was placed in position by **Omineca Projects** on ground held by Stuart Wood. The dredge has a capacity of 100 yd. of gravel daily, with 6-in. pumps powered by diesel engine. Operations will commence on skids, changing to floats later in the season, if practical.

YUKON

★Value of mineral production in the Yukon during 1949 was $4,991,200, an increase of $725,290 over 1948. Gold output topped the list, partly due to a successful year by Yukon Consolidated Gold Corp. and partly because of reduced silver-lead output by **United Keno Hill Mines Ltd.**, as a result of destruction of United's mill by fire in the spring of 1949. A new mill was in production by the year-end. Yukon Consolidated produced 59,065 oz. gold and 12,919 oz. silver from 8,556,300 cu. yd.

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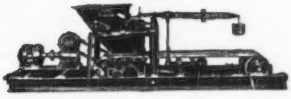

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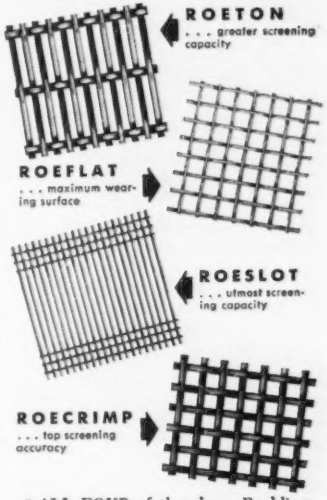

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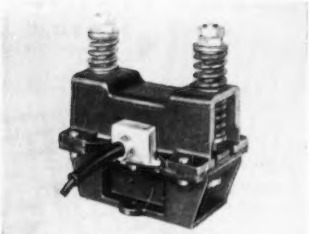

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IN LATIN AMERICA

- Itabira faces delays
- Strikes plague Mexico

BRAZIL

★**A delay of at least another year** in getting Itabira's output of iron ore up to the projected 1,500,000 metric tons yearly is forecast in the annual report of **Cia. Vale do Rio Doce,** released recently. CVRD operates the mine on Caue Peak and the Vitoria e Minas Railway that serves the region.

Ore production last year from Itabira is reported at 476,786 metric tons, of which 471,910 tons was exported. This output is up roughly 100,000 metric tons over 1948. The forecast for 1950 is now only 750,000 metric tons. The goal of 1,500,000 has been pushed back once more, this time to 1951.

★**The first shipment** of manganese ore from the deposits recently discovered in Amapa, north of the Amazon, reached Macapa, capital of Amapa, early in May.

★The Minas Geraes mines of the **Volta Redonda** steel works produced 271,000 tons of hematite in 1949, 13,853 metric tons of manganese ore, and over 47,000 tons of limestones. Output of finished steel products came to 225,887 tons. In giving these figures in his annual message to the Congress, President Dutra called attention to the need for increasing output of the steel plant. Presumably such increase would be financed out of a $20,000,000 loan now being studied by the Export-Import Bank.

CHILE

★The Chilean **Nitrate and Iodine Corporation** has announced that it has decided to lower the price of iodine in the United States to $1.52 per lb. This cut is owing to competition from Asiatic iodine. Chilean iodine is obtained as a by-product from the liquors obtained from leaching sodium nitrate ore. This is by far the largest source of iodine in the world.

★The new evaporation plant at **Pedro de Valdivia nitrate** *oficina* was ready to start in May. This is the first plant to use the sun's rays as a source of heat.

★The *Caja de Credito Minero* (the Mining Bank) is investigating thoroughly the possibility of building a **lead smelter** to supply Chile's needs for lead, which come to about 3,000 metric tons yearly. The country has enough lead mines to take care of this tonnage, although production has slumped badly in these recent months.

★An unusual accident took place recently at **El Torno** mine near Andacollo. While several miners were on surface eating lunch, the ground caved under them, burying and killing five men out of six. The cave was into an open stope in the mine.

★According to Government statistics, **copper production** of Chile in 1949 was only 371,094 metric tons, against 449,949 in 1948. Iron ore output was up from 1,681,480 to 2,742,914 metric tons. Gold output increased from 5,109 kg. in 1948 to 5,572 kg. in 1949. It is expected that gold output will increase greatly in 1950 because of the new gold law and its stabilizing effect on the gold price in Chile.

★**Cia. Minera Aysen,** near Lago Buenos Aires in southern Chile, is producing about 2,400 metric tons of high-grade lead ore per year. This ore, which runs about 65% lead, is sold to an Argentine subsidiary of the French Penarroya Co. The group operates a lead smelter near Buenos Aires. Aysen plans soon to increase its production with a 60-ton mill that is nearly ready. The mill will treat ores running about 30% lead and 20% zinc. Aysen's chief difficulties lie in poor transport of ores and supplies. Its surroundings are very much like the more remote parts of Alaska.

★**Cia. Minera Delirio de Punitaqui** has begun to build a 70-ton cyanidation and flotation mill. The mine has two types of ores: one is a straight cyaniding ore found in the leached upper levels of the mine. The other is a copper-gold ore found in the secondard and primary sulphide zones.

★Manganesos de Atacama, the **only Chilean manganese company** that has kept on working since the end of the war, made a nice profit of 4,500,000 pesos last year with a capital of 14,000,000 pesos. The company has a good mine near La Serena.

MEXICO

★Strikes continue to plague Mexican mines with the large Fresnillo lead and zinc mines in Zacatecas still strike-bound by 3,000 miners. **The strike at Fresnillo** began early in March and the miners have held firm for a 28% wage increase while the company refuses to budge beyond a 14% increase. The miners are also asking for full wages during the time they were idled by the strike.

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Mexico *(Continued)*

Refining settled one big strike at their Chihuahua smelter with a 14% wage increase, which held some hopes that the entire industry might come to terms at this figure, A S & R is faced with further strike calls at their Santa Barbara mine on June 4 and the Prieta mine on May 15. Negotiations are about to begin over these two contracts.

★Another problem for mine operators in Mexico is an expected **20% tariff increase on the Mexican National Railroads** which comprise most of the lines in Mexico. This increase is expected to produce 60 million pesos in new revenue. The railroads have been running at heavy losses for some time and have had to turn repeatedly to the government for assistance.

Although they have been given a $12 million dollar loan by the Export-Import bank for modernization, it is still contended they cannot operate at the old tariffs. As ore haulage makes up a substantial part of their traffic, it will be mine operators who will be caught for most of the required new revenue.

★**Carbonifera Unida de Palau S. A.,** in the state of Coahuila in northern Mexico, has been the recipient of a $2.7-million dollar loan from the Export-Import Bank for the development of its coal fields. It is the principal supplier of the iron furnaces in the adjacent areas of Monclova and Monterrey.

The loan, endorsed by the Mexican government, carries a 3.5 interest rate and will be repaid in three years beginning in 1952.

The first project will be a new coal washing plant which will be completed by July according to present plans. This plant will cost some $275,000 dollars. (It is reported that this plant is being built by Allen & Garcia of Chicago, with supplies from the Jeffries company. However, this cannot be confirmed here in Mexico City.)

The rest of the funds will go into general modernization and mechanization of the mines. One old mine will be renovated while a new mine will be added. The Pierce Management, Inc., of Scranton, Pa., has been given a contract for design and supervision of some of this work.

★Several groups have developed an interest in possible **perlite mining** in Mexico. One report says some perlite has already been shipped out of a field near Chihuahua in northern Mexico to the U. S. Another group is interested in possible perlite mining near Mexico City and is now making studies of this location. A third possible source of commercially profitable perlite is said to be in the Isthmus of Tehuantepec.

★**The Mazapil Copper Co.,** an English firm, has moved several lead smelters to a new location at Concepcion del

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Oro, in Zacatecas, to handle production from their own mines. The smelters, which have been out of service for the past 15 years, were overhauled and placed in service April 17. They can handle 235 tons per day, the operators report.

★**Metalurgica Occidental, S. A.,** have recently put a new smelter in operation at Mazatlan, in Sinaloa, in western Mexico.

★**American Smelting and Refining** has organized a new 25-year club for Mexico chartered under its main 25-year club in New York. In the Chihuahua plant alone over 100 men have become eligible for membership, while it is expected that several hundred will be enrolled from other A S & R divisions in Mexico. Pins and certificates are being given the new members.

★**The Mexican mint** has now placed two and one-half million 25 centavo coins of "silver" in circulation. This is the first time that this denomination has been coined in Mexico and will probably serve to replace the much heavier 20 centavo copper coins that have been used for years. The new coin, weighing three and one-half grams, has a diameter of 21.5 milmetros and actually consists of 30% silver, 10% nickel, 10% zinc, and 50% copper. A similar 50 centavo coin is planned.

★**Cerro de Mercado** mine at Durango, in northern Mexico, has purchased considerable new equipment and expects to place it in operation very soon. It supplies iron ore both to the Monterrey furnaces and for export.

★It is reported in Mexico City that the **U. S. Bureau of Federal Supply** is planning to purchase in Mexico 10,000 tons monthly of 20-30% low-grade maganese for concentration at a plant to be located at Brownsville, Texas.

PERU

★The new 330-ton concentration plant of **Cia. Minera Atacocha** at Chicrín, northeast of Cerro de Pasco, began operations on March 5. Equipment at the plant includes a new aerial tram to carry 20 tons an hour, electric locomotives, a 50,000 v. high tension line to carry 1,200 kw. from the **Cerro de Pasco** power plants, and two new compressors, each with a capacity of 1,700 cfm.

Atacocha started operations in 1937 with a 100-ton flotation mill and a 500-kw. hydroelectric plant. In 1942 an identical turbine was installed, increasing the plant capacity to 200 tons a day.

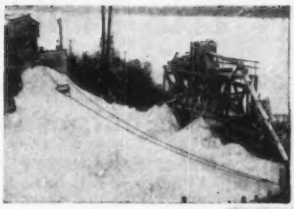
The mine, which is 20 mi. from Chicrín at Atacocha, is connected to the concentrators by an aerial tram. The ore deposit has produced so far 600,000 tons of ore averaging 12% lead, 7% zinc, 10 oz. silver, and 0.051 oz. gold. Reserves are said to be sufficient for at least ten years at the present rate of production.

★The complete plans for a railroad from **Tambo del Sol,** a point on the Oroya-Cerro de Pasco railroad, to **Pucallpa,** a port on the Ucayli river, have been announced by the Peruvian Government. Since 1949, when the government decided to build the railroad, a great deal of surveying, including aerial photography, has been conducted.

In its announcement, the government requests any Peruvian or foreign concerns interested in financing or building the railroad to send their representatives to study the project.

★Plans are under way for the installation of a new 4,000-kw. hydroelectric plant at **Chaprín** on the Huallaga river. The plants will eventually treat 1,000 tons of ore per day. In the mine, a 3,000-meter tunnel has already been started on the 3,600-meter level, planning to cut the veins 300 meters below the lowest present level.

★**San Juan de Lucanas** mine of the *Consorcio Minero del Peru,* located inland from Nazca, has cut a new rich vein 180 meters below the old workings. The 3.40-meter wide vein has sections which have assayed up to 640 oz. silver and 1.3 oz. gold. The present 100-ton mill is now being enlarged to treat 200 tons of ore by flotation.



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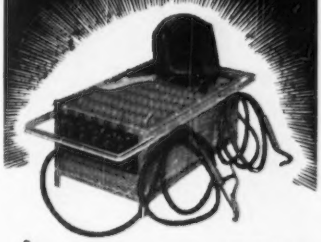

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IN THE PHILIPPINES

• Lepanto expansion proceeds
• Gold output Increases

★Gross value of the production of the **principal Philippine gold mines** in March was $912,263 at the statutory price. This was an increase of $42,000 over January. Tons milled during the month totalled 94,300, averaging $9.60 per ton. As usual, **Benguet-Balatoc** accounted for over 60% of the total tonnage milled and 50% of the bullion production for the month. During March the Benguet-Balatoc Co. realized about $48 per oz. for bullion sold on the open market, but the price fell to $45 in April.

★**Lepanto Consolidated** milled 16,370 tons in March, with smelter value of $227,600. The expansion program to 1,000 tons daily capacity is well under way. Most of the machinery and equipment has already arrived and much of it has been installed. Barring unforseen accidents, operations at full capacity should start around July.

★Shipments of chromite refractory ore from **Consolidated Mines** at Masinloc picked up sharply in March with 20,500 tons sent to Philadelphia. April shipments are expected to reach 17,000 tons. **Acoje Mining Co.,** which operates a deposit of metallurgical grade chromite north of Masinloc, shipped 4,200 tons in March. This company is seeking funds from its stockholders to build a mill to concentrate its lower grade ores. According to the general manager the available supply of high grade ore is decreasing, but very large reserves of milling grade have been developed. Total production during 1949 was 102,279 tons of which 62,947 tons was shipped. Ore reserves on Dec. 31, 1949, show a total of 765,150 tons which will produce 400,000 tons of concentrates and lump ore for shipping.

★**Mindanao Mother Lode** milled 9,100 tons of $16 ore in March, grossing $147,500. This compares with an average recovered value of $17.08 per ton in 1949. Operating cost during that year was $15.14 per ton including depreciation. Production cost, including mine production tax and administration, was $12.15 per ton. April production is expected to gross $150,000.

★Work is being resumed at the **Itogon mine** in Baguio and some equipment is being purchased from the Masbate Mill for building a 300-ton mill. Other mines controlled by **Marsman & Co.,** who also operate Itogon, are being rehabilitated on a limited scale. These include United Paracale, Coco Grove, and San Mauricio. **Baguio Gold,** an independent prewar gold producer, is also planning to rehabilitate and rebuild its mill which was destroyed during the war.

★A new contract has been made by the **Philippine Iron Co.** to ship an additional 300,000 tons of ore to Japan which will prolong operations for at least another year. If this contract is successfully completed, the Philippine Iron Mines will have shipped Japan nearly 700,000 tons of iron ore. A good demand for Philippine iron ore is expected on account of the loss of iron ore from Hainan, China, to the Communists.

IN AUSTRALIA

• Gold output lags
• Base metals increase

★**Australian gold production** for January at 65,571 oz. was the lowest for the month since 1946. The December 1949 production was the lowest since 1945. Output for the six months ending Dec. 31, 1949, during which the devaluation gold price became effective, was 443,810 oz., contrasting with 487,390 oz. in 1948.

WESTERN AUSTRALIA

★**Gold Mines of Kalgoorlie,** in twelve months ended March 28, treated 163,190 tons of ore for a recovery of 41,369 oz. The previous year's production had been 40,026 oz. An additional ball mill and subsidiary plant are being installed to lift output by 10%. Ore reserves are estimated at more than 500,000 tons averaging 5.3 dwt. This does not include rich ore in two lodes not closely estimated.

★**Central Norsemen,** in the same period, treated 137,689 tons for 44,779 oz., compared with 123,277 tons and 44,312 oz. in 1948-49. This mine, too, hopes to step up production. It has applied for a further 11 leases three miles north of the Princess Royal. A total of 27 leases, covering about 650 acres, have now been pegged.

VICTORIA

★**Morning Star,** at Woods Point, is now the state's leading gold producer. In 1949 the mine crushed 20,257 tons of ore for a return of 17,600 oz. of gold and 4,972 oz. of silver. The State Development Committee has recommended the installation of a 66,000-v. electric power line from Mansfield to Woods Point.

★An important development at **A-1 Consolidated Mine** is reported by the Department of Mines. A winze sunk on the Victory reef north of the shaft has intersected a new dyke bulge about 50 ft. east of the main dyke. The reef in the winze averaged 24 in. in width and carried payable values. In a borehole put down from the No. 17 level a formation 17 ft. thick was cut at 171 ft. and the bore core over the length averaged 4 oz. 18 dwt. of gold per ton. An electric sinking pump is being installed and the shaft will then be deepened to test the reef. In 1949 the mine crushed 12,060 tons for a return of 6,173 oz. of gold.

★**Ballarat South Goldfields** has deepened the shaft to 179 ft. It is to be sunk a further 200 ft. and crosscuts will then be opened east and west to prospect the two known lines of reef that pass through the property.

★**Central Deborah** has deepened its shaft to 1,383 ft. from the surface while Deborah's shaft has reached a depth of 2,076 ft.

★**Nillumbik,** a new gold mine at Diamond Creek, is showing promise. Excellent returns have been obtained from small crushings, indicating grades as high as 5 oz. per ton.

★**Cock's Eldorado Dredge** last year recovered 2,512 oz. of gold and 49 tons of tin concentrates from 10.7 acres of ground dredged to a depth of 90 ft. There is believed to be from four to five years' additional work in the area, particularly if the added values due to last year's exchange adjustment are considered.

★Working from the Ajax Central shaft, **Ajax Consolidated** has dewatered its group of five mines to a depth of 283 ft. The Central shaft has been retimbered to 280 ft. It is planned to install new pumping plant to dewater the mines to a depth of 500-600 ft. When this stage is reached, ground above this depth may be investigated by diamond drilling.

★**Hercules Gold Mining** has suspended operations at Bendigo. All underground equipment is to be brought to the surface. The Central Nell gold mine, also at Bendigo, was closed down in January, but directors are exploring the possibility of interesting outside capital in further development of the mine.

★**Mount Morgan's** production returns for recent four-weekly periods indicated a steady upturn in copper and

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Victoria *(Continued)*

nages treated. In the four weeks ended April 2, the mine produced 6,563 oz. of gold and 382 tons of copper from 62,200 tons of ore.

QUEENSLAND

★With the exception of copper, wolfram and lode tin, **Queensland's metal production** recorded increases in the last quarter of 1949 in comparison with the October-December quarter in 1948. While there was a slight decline in load tin production, output of alluvial tin was trebled.

★**Mount Isa's** production of zinc concentrates set a 1950 record in March with 4,200 tons. Production of silver-lead bullion for the month was back to the recent average of 3,000 tons after a slump in February. Stripping and concreting is in progress on the Davidson shaft. On the No. 10 level of the man and supply shaft, formwork is nearing completion as the first step in building an all-concrete underground structure. Construction is also going ahead on the new copper milling and smelting section.

NEW GUINEA

★**Bulolo** gold production for nine months to February 28 was 56,247 oz., compared with 52,235 oz. for the corresponding period of 1948-49. The increase was achieved although values averaged 25% lower — 18.30c. per yard against 24.84c.—and although the No. 5 dredge was incapacitated in the latter part of the period.

★Stockholders of **Cuthbert's Misima Goldmine, Ltd.,** will be asked to agree to the appointment of a liquidator to wind up the company. This follows failure of the recent debenture issue of £30,000.

SIAM AND MALAYA

★**Tongkah Compound No. 3** dredge began production in February and 2 tons of tin ore were won up to March 15. The dredge is in previously unworked ground and is expected to have a working life of 8½ years. The Siamese government has indicated that the company cannot expect full settlement of its indemnity claim for £237,000 sterling, which includes loss of profit and other losses incidental to the Japanese occupation. However, settlement of direct damages is now in sight.

★**Tongkah Compound N. L.,** the associated company in Malaya, earned a record profit of £152,568 after taxes in the year ended September 30, 1949. Profit in 1947-48 was £69,159. In 1948-49 the dredge treated 1,504,147 cu. yd. for 540 tons of tin oxide.

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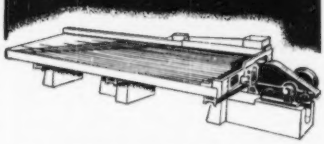

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IN AFRICA

• Egypt's manganese all to USA.

★An American firm has offered to sell in the United States, **Egypt's total output of manganese ore** for the next five years. Commission would be 2%. Egypt's annual output runs around 150,000 tons. It comes from the Sinai peninsula and the Eastern Desert.

Bethlehem Steel has signed up for 100,000 tons in 1950, and another American group has offered to buy the remainder (50,000 tons), if the grade in both manganese and iron can be held over 30%. The Egyptian Mining Department says that all these offers have been accepted, with payment in dollars. For the next five years, therefore, all of Egypt's manganese will go to the United States.

★**Beryl** is being mined in the **Bikita tin field** 50 miles east of Fort Victoria in Southern Rhodesia. With the present price of beryl at the dollar equivalent of £80 per ton, the mineral is eagerly sought. The district's busiest miner recently shipped 96 tons of beryl in one month. American geologists looking for uranium first called the attention of local residents to the value of the beryl.

★An intensive development program has been carried out in the Barberton area for **Fairview Consolidated Mines, Ltd.**, with encouraging results, according to a recent report of Union Gold & Base Metal Corp., Ltd. A crosscut on the seventh level in the Fairview mine plant intercepted reef, giving a sampling value of 23.3 dwt. over 30 in.

★Since the inception of the scheme to use **South African gold for industrial and artistic purposes,** up to the end of February, South African mines had sold 1,271,285 oz. of gold for such purposes. The revenue picked up by the gold mines in this way was £2,811,000 before devaluation, and £13,652,000 after devaluation. Extra profit to gold mines represented by this revenue was £1,692,000.

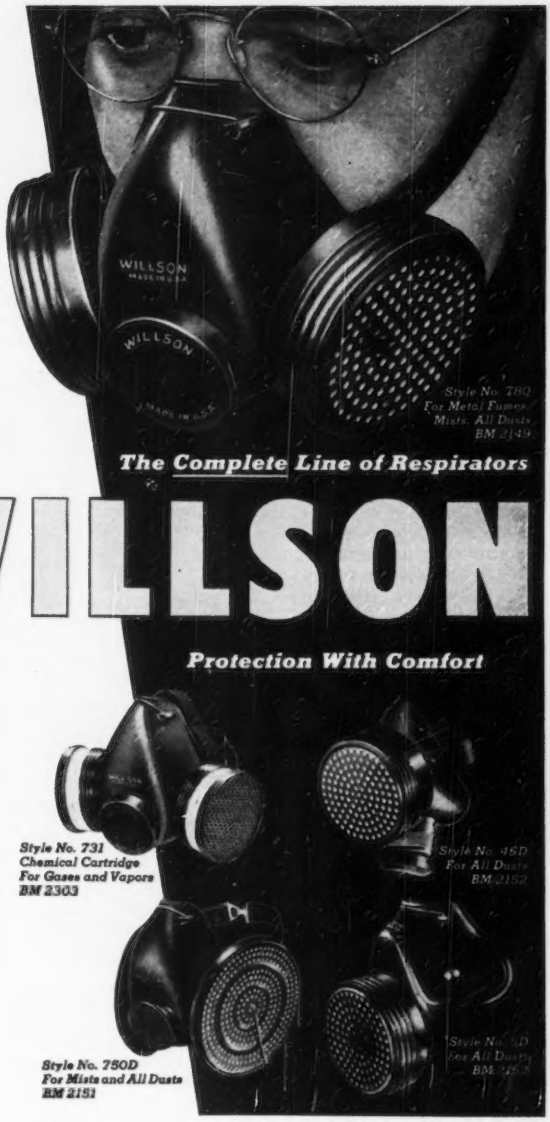
★**As a result of devaluation,** dividends declared by the gold mines for 1949 totalled £11,315,211.

Correction

In the article, "Shaft Surveying Method Features Accuracy" (April, 1950, p. 90), there were two typographical errors which should be corrected.

Line 8 from the bottom of the page, column 2, p. 90 should read, "using a small angle, 2 min. to 15 min."

Line 6 from the bottom, column 2, p. 91, should read, "360 deg. plus or minus 10 sec."



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IN ITALY

• Mercury cartel splits in price war

★**Italian output of lead** was off slightly in 1949, amounting to 26,000 tons against 1948's 27,000 tons. Zinc production was unchanged at 27,000 tons. Shortage of electric power cut aluminum output from 32,000 tons in 1948 to 26,000 tons in 1949. Exports of these metals dropped considerably in 1949. Lead exports dropped from 25,000 tons in 1948 to 3,000 in 1949. Zinc fell from 7,000 to less than 2,000 tons. Aluminum dropped from 17,000 to 5,000 tons.

★**Imports of non-ferrous metals** fell off in 1949, with the exception of zinc. Copper imports fell from 72,000 tons in 1948 to 57,000 in 1949. Aluminum imports lowered somewhat from 1948's 9,000 tons, but lead imports dropped from 10,000 to 7,000 tons. Zinc imports rose however from 1,500 tons in 1948 to 2,200 tons in 1949. Available supplies of non-ferrous metals in Italy were generally sufficient in 1949, with the exception of primary aluminum in January and of electrolytic copper at several times during the year. Metal scrap of all kinds was in short supply owing to the exhaustion at last of battle scrap.

★**The break-up in the mercury cartel**, through which Spain and Italy for so many years controlled world prices and production of mercury, arose over Italy's huge sales of mercury to the United States at a price below that fixed by the cartel, according to persistent rumors. The sale referred to was for 83,562 flasks, and was arranged through the ECA. The metal went into the national stockpile in the United States. Spain's sales of mercury in the United States at the same time (second and third quarters of 1949) amounted to 885 flasks.

The Spaniards charge that this overbalance broke Italy's cartel agreements by which Spain was to sell 60% of the cartel's output and Italy 40%. The Spanish producers wound up the cartel and promptly undersold the Italians, which they are able to do because of the unparalleled low cost of Spanish mercury from Almaden. Faced by Spanish offers of quick at $47 per flask, fob Spanish ports, Italian producers say that the export trade no longer interests them.

This, of course, is a position that can not be maintained because the export trade is vital to Italian mercury miners. A counter-offensive will come from the Italian producers, but when and in what form, it is impossible to say. Best guess is that the cartel will eventually be re-established, because it is no help to either country in the long run to carry on a price war.

Washington Briefs

(Continued from page 91)

priations bill that is important to mining. Introduced by Rep. Thomas (D., Texas), it would limit stockpiling purchases in the U. S. to $25-million. The Senate probably won't let the amendment stand.

WITCH HUNT—Nothing big is likely to result from recent Celler Committee steel industry hearings. The committee has finished with steel and has plans for putting other industries on the Congressional carpet for election-year window dressing. Right now plans are to issue an omnibus report on all of the big-industry hearings at one time. Even then recommendations contained in the report are unlikely to lead to any direct action. Big Steel defended itself very ably in the recently completed hearings.

Actually, the chances are much greater that there'll be an anti-trust suit filed, rather than any action by Congress, to break up Big Steel. For some time the Justice Department has been looking for a way to break up U. S. Steel.

DOMESTIC MANGANESE — Recent government-industry meeting of manganese metallurgists held at the Bureau of Mines was aimed at finding the best methods of utilizing low-grade sources within North America.

It is part of the Bureau's accelerated program to assure maximum U. S. independence from foreign ore sources in time of war. Russia has already effectively cut off exports to the U. S., and in war time ocean-borne supplies may be jeopardized despite the fact that Union of South Africa, Gold Coast and India are rapidly filling the manganese gap left by the Soviet embargo.

Disregarding production costs, the North American continent can be made temporarily self-sufficient in manganese, even taking into account the added demands of war production. These sources include recovery from slag as well as low-grade ore deposits in the U. S., Mexico, and Canada.

ST. LAWRENCE—The St. Lawrence seaway is finished for this year. That's the result of a House committee vote to wait for the Senate to take up the bill. Senators have no intention of getting to it before 1952.

NLRB ROW — The Administration took a licking in its attempt to restore NLRB's previous status as a tribunal where labor could be sure of bias in its favor. The move to abolish the independence of the general counsel was defeated by the Senate 53-30 on May 11.

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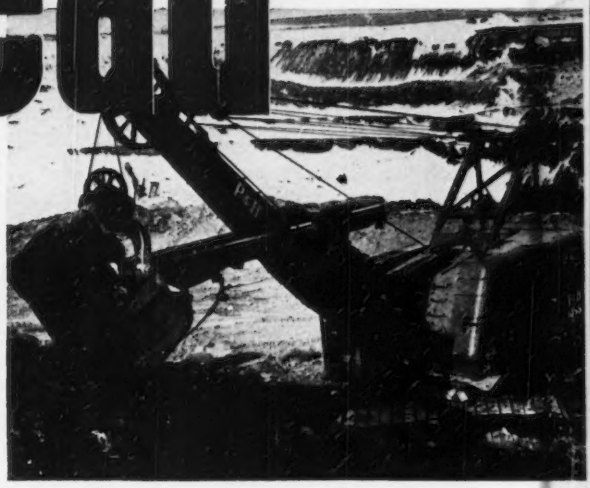

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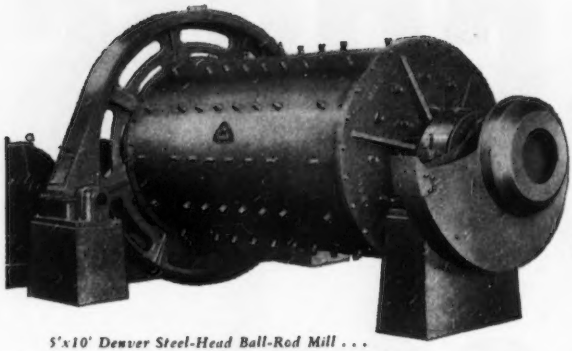

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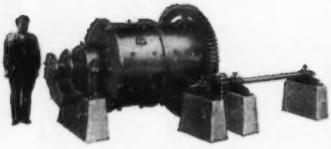

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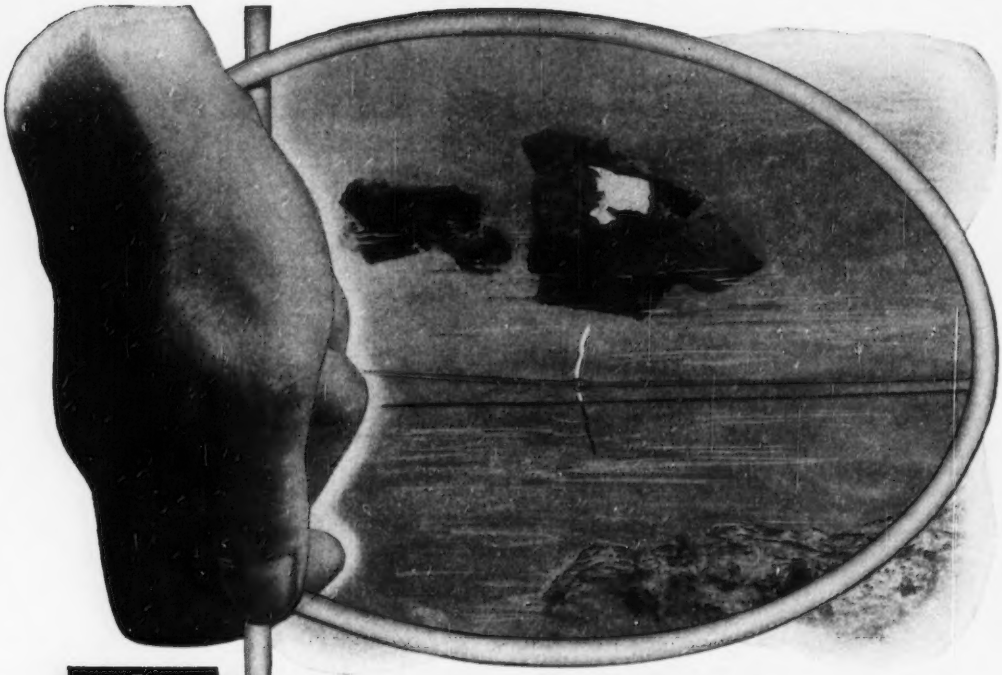

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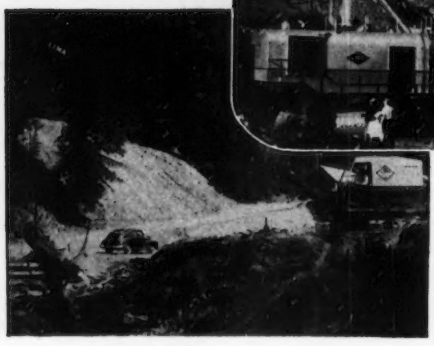
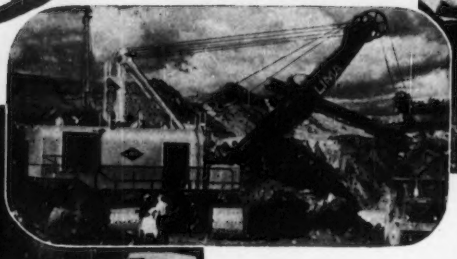
SHOVELS, CRANES AND DRAGLINES...

Strip more *Dig more* *Load more*





(Above) LIMA Type 604 Shovel, with 23 foot boom, 18 foot dipper handle and 1½ yard dipper loading iron ore from stockpile at Keewatin, Minn.

(Center) LIMA Type 2400 Shovel with 36 foot boom, 25 foot dipper handle and 6 yard dipper digging and loading iron ore.

(Left) LIMA Type 34 PAYMASTER, equipped with 45 foot boom, excavating lead and zinc tailings to be reclaimed near Wallace, Idaho.

because of CONTINUOUS OPERATION

Breakdowns in mining operations are costly—not only because of difficult on-the-job maintenance, but also because of down time of expensive equipment and labor. That's why LIMA shovels, cranes and draglines, with extra "built-in" stamina for the rugged job of coal stripping and open cut mining, pay big dividends by assuring continuous operation with maximum output at lowest cost.

Sturdy unit-type construction, simple, rugged design, low center of gravity, long wide crawlers, permanent shaft alignment, smooth running anti-friction bearings, ample power for big output, big cable drums, air-operated clutches, large braking areas, and maximum use of properly selected heat-treated alloy steels—these are only a few features which help you *strip more, dig more* and *load more* with a LIMA.

The LIMA line includes Shovels ¾ to 6 yards, Cranes to 110 tons and Draglines variable. Rubber-Mounted units are available for ¾ and 1 yard Shovels, and Cranes to 35 tons. Lima Sales and Service offices in principal cities of the world.

Lima Shovel and Crane Division

LIMA, OHIO

LIMA HAMILTON CORPORATION

OTHER DIVISIONS: Lima Locomotive Works, Inc.; Niles Tool Works Co.; Hooven, Owens, Rentschler Co.

Reduce Blasting Vibration

and Improve Fragmentation

In many blasting operations you get more work out of your explosives when you use Hercules "No-Vent" Short-Period Delay Electric Blasting Caps. You reduce earth vibrations, noise, backbreak, and endbreak; and at the same time get better fragmentation. You break more material, and break it in better shape for digging, hauling, and crushing. This saves you money at every step in your operation.

A complete series of Short-Period Delays gives twelve closely-timed delay intervals in approximately 400 milliseconds. By various arrangements of these delays, the delay effect is secured in blasts of practically any number of holes.

For details and guidance in using "No-Vent" Short-Period Delays in quarries, open-pit mines, underground mines, coal stripping, and construction, return coupon.

Return Coupon for 12-Page Descriptive Booklet

HERCULES POWDER COMPANY
INCORPORATED
933 King Street, Wilmington 99, Delaware

Send 12-page booklet, "Hercules No-Vent Short-Period Delay Electric Blasting Caps."

Name_____ Title_____

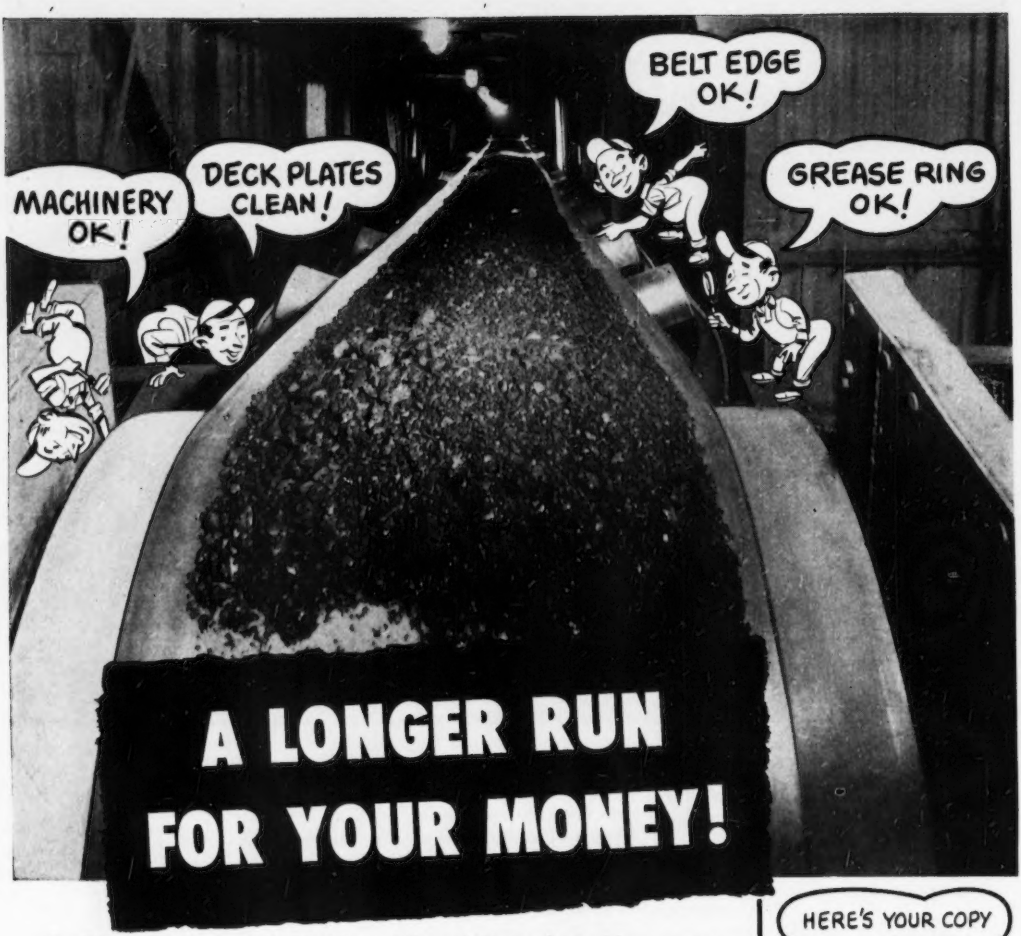
Company_____

Street_____

City_____ State_____

"NO-VENT" IS A TRADE-MARK

XR50-7



A LONGER RUN FOR YOUR MONEY!

Rex Idlers are built to last. Triple labyrinth grease seal . . . tapered roller bearings . . . extra large grease reservoir . . . these are a few of the Rex advantages that mean longer life for idlers, belts and machinery parts. Even if just one idler "freezes up," the belt can wear through the roll shell in a matter of hours, leaving knife-like edges to cut the belt. Rex Idlers are fully greased at the factory and will operate for long periods even without minimum maintenance. But Rex Idlers, or any other make, will give far longer service if minimum maintenance rules are followed. The fact that many Rex Idlers are still going strong after more than 25 years of service is, we believe, proof of the pudding.

Idlers, belts and machinery parts should be inspected periodically, depending upon amount of use. Greasing and servicing should be done as indicated by inspection. (Normally, 1000 operating hours is the average greasing period). Inspection should include the following checks:

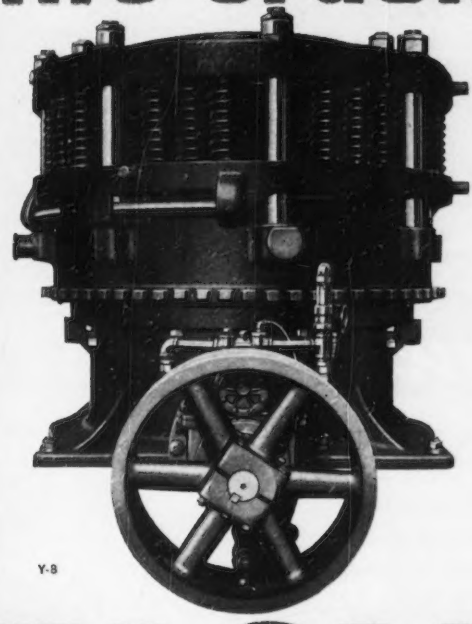
1 All rolls turning freely and smoothly, with no excessive bearing end play.
2 All rolls properly seated in brackets.
3 No unusual damage to rolls, brackets or base.
4 Evidence of adequate greasing at seals but no excessive amount. Don't overgrease.
5 Check for accumulation of material under rolls. Keep deck plates clean.
6 No buildup of material on return rolls.
7 Grease pipes and fittings in good usable condition. No broken pipes or missing fittings.
8 Belt running true and self-aligning idlers operating freely.

You'll find it pays to follow these tips. For more detailed information on idler care, approved idler greases, and for all the facts on the complete Chain Belt Idler line, send for Bulletin 463-R. Chain Belt Company, 1679 West Bruce Street, Milwaukee 4, Wis.

CHAIN BELT REX COMPANY

BELT CONVEYOR IDLERS

new Style FC fine crushing



Y-8

- new heavy-duty design for finer crushing.
- longer crushing stroke for greater capacity and a finer, more uniform product.
- new mechanical features for lower maintenance and longer life resulting in lower crushing cost per ton.

Get New Bulletin No. 274

TELSMITH Gyrasphere

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One Name - ALL TYPES

All over the United States . . . in Siamese chalk quarries, South African diamond mines, Turkish oil fields, Chilean nitrate mines, Alaskan gold fields—Russia, Egypt, China and so on criss-crossing the globe many times over, Philadelphia Gears have won their place as "quality gears" in the World's workshops.

For over 58 years, Philadelphia Gears have been produced in all sizes, types and materials . . . and, today our plant, machinery, facilities, men, methods and management are better able than ever before to serve you satisfactorily and promptly.

Send for our latest 68 page "Gear Book," and please use your Business Letterhead when writing for it.

Philadelphia Gear Works, INC.

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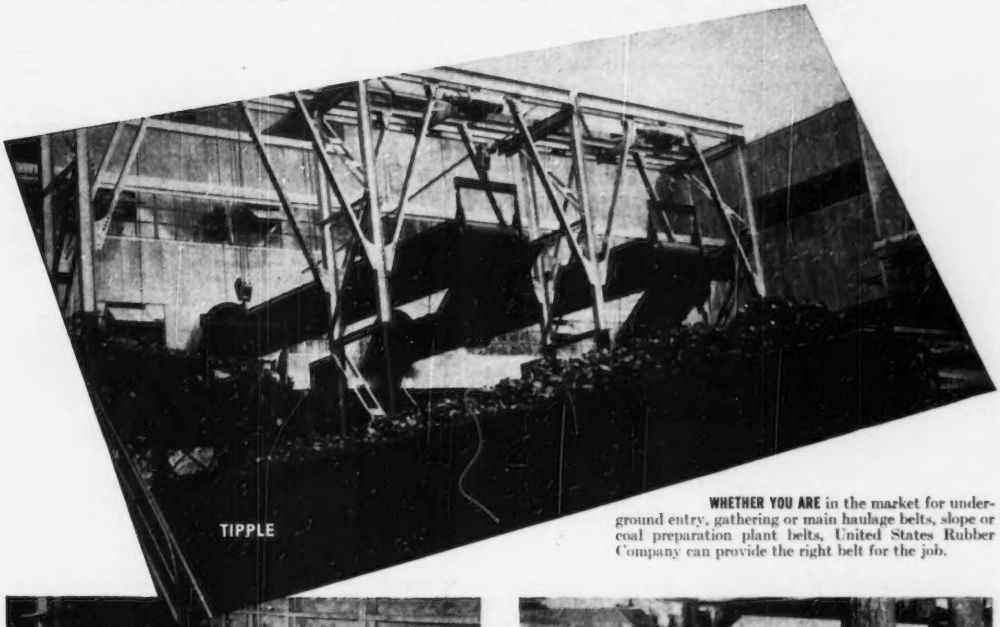
LimiTorque Valve Controls

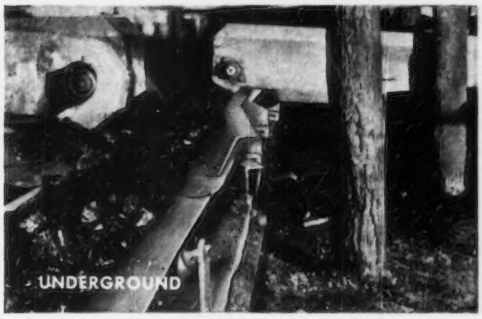
INSIDE, OUTSIDE, UP OR DOWN...

conveyor belts by U. S. Rubber deliver greater tonnage over longer hauls, and higher lifts, on every kind of coal haulage job



WHETHER YOU ARE in the market for underground entry, gathering or main haulage belts, slope or coal preparation plant belts, United States Rubber Company can provide the right belt for the job.

THANKS TO U. S. RUBBER'S splendid research laboratories, large textile mills and great factories in which the latest techniques are used, "U. S." is always able to produce belting that increases output, lowers costs. The "U. S." specialists in rubber are aided by scientists, designers and production engineers.



"U. S." TAKES THE GUESSWORK OUT of conveyor belt service by means of Coordinated Engineering, a 3-Way Team consisting of mining engineers, equipment designing engineers and U. S. Rubber engineers. Their united efforts result in conveyors which move materials efficiently, handle output at minimum cost.

When you plan a new conveyor system, big or small, or when your belts need replacing, get in touch with United States Rubber engineers. They will help you solve your belt problem. Write to

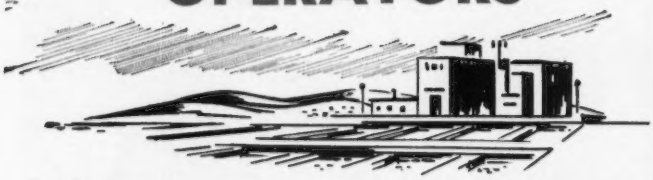
A PRODUCT OF

U.S.RUBBER
SERVING THROUGH SCIENCE

UNITED STATES RUBBER COMPANY

MECHANICAL GOODS DIVISION • ROCKEFELLER CENTER, NEW YORK 20, N. Y.

Important FACTS ABOUT pH for MINING & MILL OPERATORS



WHETHER you are building a new plant or modernizing present equipment, one of the most important advancements you can make in your mill operations is the installation of BECKMAN pH CONTROL. Throughout the mining industry — in gold, tin, tungsten, lead, zinc, copper and many other flotation operations — Beckman pH Control is proving to be the key to much higher recoveries, better control of processes, lower labor and chemical costs. Result — substantially greater profits per ton of ore. Some of the many benefits resulting from Beckman pH Control include . . .

. . . greater speed, convenience and accuracy in laboratory leaching or flotation tests.
. . . opportunity for centralized, or automatic, control of multiple flotation circuits.
. . . reduction of corrosion and scaling in mine pipe lines.
. . . improved, or automatic, control of electrolytic operations.
. . . better control over waste disposal to eleminate contamination of lakes and rivers.
. . . *and many other vital savings in mining and mill operations—savings that will quickly pay for the installation, and will continue producing extra profits throughout the years!*

BUT TO MAKE CERTAIN you get the latest, most convenient and most accurate pH equipment available, *be sure to specify* "BECKMAN"...

Beckman pH equipment is completely electrometric, eliminating the mess and inaccuracies of colorimetric methods. Simply press a button and the exact pH of any process is instantly shown on a large easily-read dial. *It is the simplest of all pH methods!*

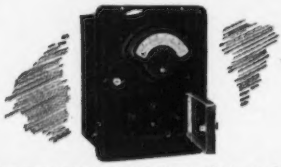
The accuracy of Beckman pH readings is completely unaffected by human errors in color judgment, by turbidity, oxidizing or reducing agents, by suspended materials, colored process solutions or other variables that affect outmoded colorimetric methods. *Beckman pH readings are universally accurate and dependable!*

With Beckman equipment no time-wasting or troublesome sampling devices are needed. Beckman pH electrodes may be installed directly in vats, tanks, channels or flow lines—and exact pH values read instantly—and continuously, if desired—on the process fluids themselves.

Unique rugged-type Beckman Electrodes, specially designed for direct immersion in abrasive or suspension-laden fluids, reduce maintenance to an absolute minimum. *Beckman is the most trouble-free of all pH equipment!*

Helpful Bulletin! *A Beckman Bulletin outlining interesting pH applications in the mining industry is available and will gladly be sent without obligation. Ask for pH data on mining applications.*

THERE'S A BECKMAN pH INSTRUMENT FOR EVERY NEED



COMPLETELY AUTOMATIC! The Beckman Model R instrument operates directly from standard 110 v. A.C. lines to provide completely automatic pH indication. Also provides for completely automatic pH recording and automatic process control. Can be installed to give accurate pH readings from various stations in plant through one instrument. *This is the pH unit being installed by today's most modern plants, large and small.*

PORTABLE A.C. OPERATION! The Beckman Model H instrument can be quickly moved from one part of the plant to another and plugs directly into standard 110 v. 50/60 cycle A.C. current. Compact, convenient and extremely simple to operate, the Model H gives instant pH readings on an easily-read dial. It is widely used both for manual pH control of small plants and as an auxiliary instrument on completely automatic pH installations.

COMPLETELY SELF-CONTAINED! The Beckman Model M is the ideal pH instrument where *complete* portability is desired. Operating from its own self-contained, long-life power supply, the Model M can be used *anywhere* in the plant or field, whether convenient to power lines or not. Features the same accuracy, simplicity and operating speed as the Model H, and is also widely used both for manual pH control of small plants and as auxiliary equipment on large automatic installations.

Write for literature on Beckman pH Equipment!

BRING YOUR pH PROBLEM TO US. Our trained engineers will gladly study your problem and recommend the equipment best suited to your particular requirements. No obligation, of course.

BECKMAN INSTRUMENTS, Inc.
South Pasadena 27, California
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BECKMAN **INSTRUMENTS CONTROL MODERN INDUSTRIES**

THE S-D "FLOATER"...

America's No. 1 Mine Car Wheel!

"FLOATERS"

FOR FASTER . . . CHEAPER HAULING

Independent engineering firm tests prove that locomotives can pull up to 50% greater loads with no additional power requirement when cars are equipped with S-D "Floaters" instead of other types of precision bearing wheels . . . a big power and time saver!

"FLOATERS"

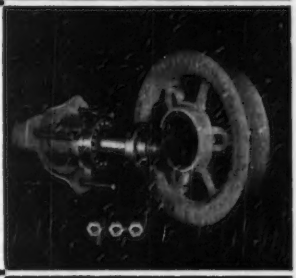
FOR LESS MAINTENANCE . . .

With "Floater's" solid closed front hub, and back double seal, grease stays in the wheel, dust and dirt stay out. Often "Floaters" require greasing no more than once in five years.

"FLOATERS"

FOR QUICK DEMOUNTABILITY

Any unskilled worker can remove and replace a "Floater" as easily as changing an automobile wheel. Bearings always remain in perfect adjustment on axle. When replaced there's no chance of pinching, misalignment, loose or tight bearings.



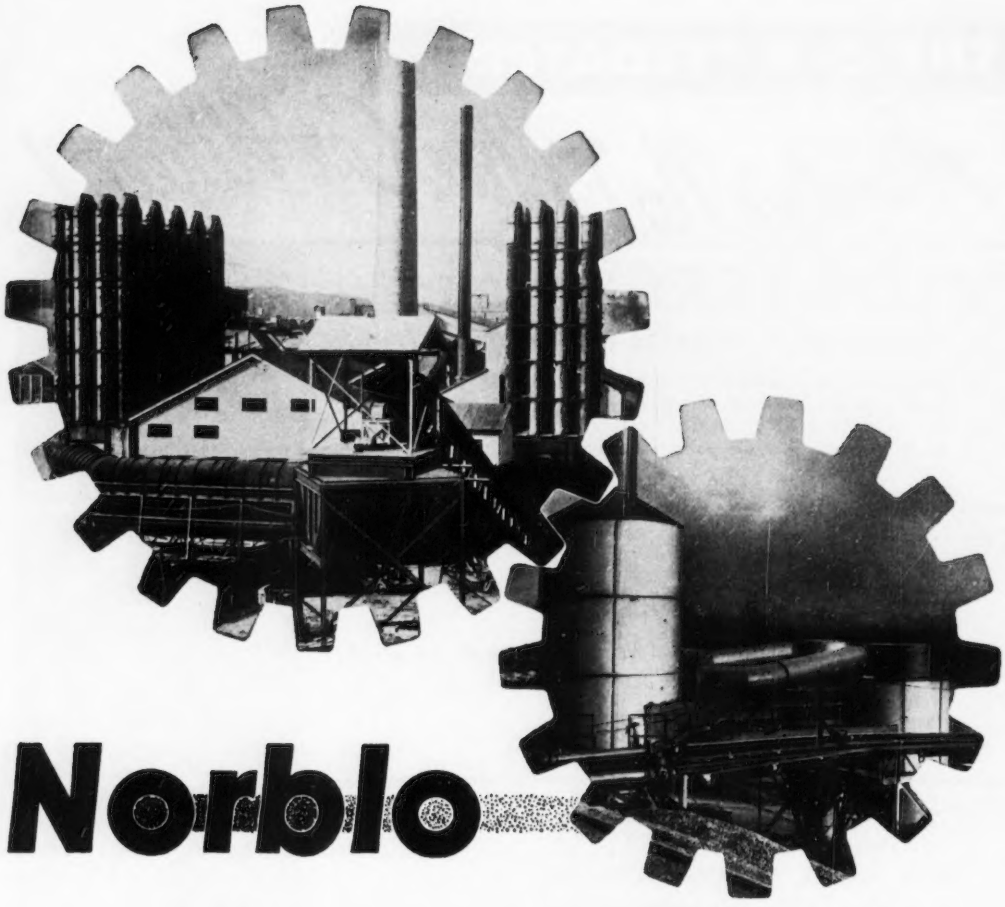
"FLOATERS"

FOR LONGER WHEEL LIFE

We believe our own special mixture of iron and exclusive heat treatment are responsible for making "Floaters" famous for their toughness and long wear . . . such quality is your assurance of perfect satisfaction.

Try S-D "Floaters". Check their savings. Experience proves that once an operator knows what "Floaters" will do for him, he specifies smooth-running "Floaters" for all wheel replacements. For complete information, write Sanford-Day Iron Works, Knoxville, Tenn.

SANFORD-DAY IRON WORKS



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Heavy Duty

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With three types of dust collectors — automatic bag, centrifugal and hydraulic — Norblo installations are geared to the heavy duty requirements of the smelting, mining, cement and rock products, foundry, chemical and milling industries.

Norblo Automatic Bag Type dust and fume collectors are outstanding in performance in continuous operation. These units are adjustable for varying dust load without shutting down. The periodic short cycle cleaning, automatically controlled, insures sustained collection efficiency at maximum. May we send you a handy Norblo Airflow Calculator — no obligation.

The Northern Blower Company

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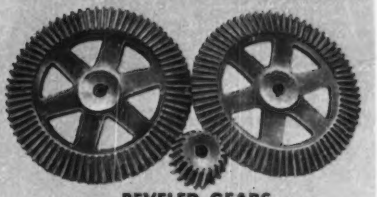
Automatic and Standard Bag Type Fume and Dust Collectors • Norblo Centrifugal and Hydraulic Collectors • Cement Air Cooling Systems • Exhaust Fans

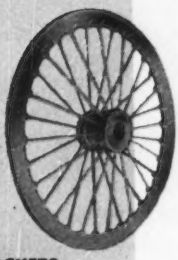
GIRTH AND PINION GEARS

SEGMENT TIRES



BEVELED GEARS

TRUNNIONS



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Kilns	**Rod Mills**	**Compeb Mills**
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Since 1916!

Specialists in the fabrication of gears, tires, trunnions, sprockets and allied parts for kilns, coolers, dryers, ball mills and similar processing equipment . . . Stroh engineers have perfected a method of applying a high grade, wear-resistant alloy steel to *the wearing surfaces* only of plain carbon steel. Proved in service . . . replacement parts by Stroh assure you of maximum service life . . . economical, smooth operation of equipment. Let us show you case studies of outstanding performance. A representative will gladly call at your request, or we will quote on your requirements on receipt of your inquiry.

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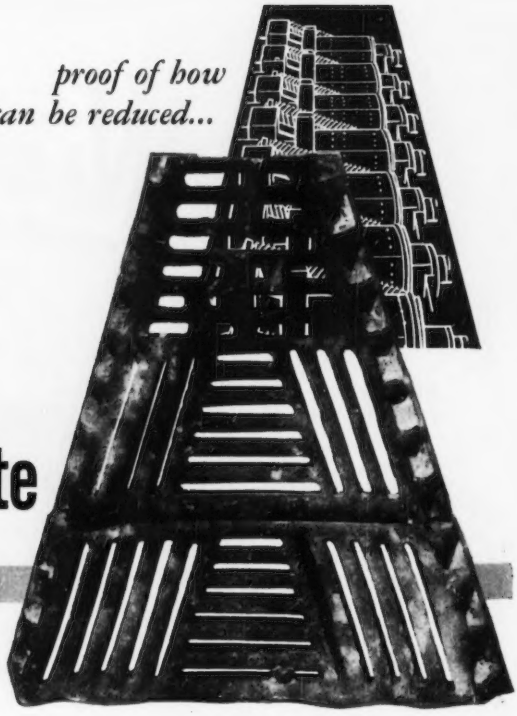
Manufacturers of STROH ALLOY CAST TOOTH GEARS; CAST OR CUT TOOTH CARBON STEEL GEARS

proof of how milling costs can be reduced...



this AMSCO® Grate has milled 193,797 tons

An actual example of how AMSCO Grates last longer, reduce shutdowns and increase milling profits.

Equally Big Savings On Liners, Too!
Recent production figures on Amsco double-wave Liners in a mill grinding copper ore: 667,308 tons ground . . . at a liner cost of about a half-cent per ton! *It will pay you to investigate the long, low-cost service of Amsco Liners!*

Find out more about Amsco Liners and Grates

Be sure to ask for a copy of Bulletin 449-ML. Describes the characteristics of Amsco ball mill alloys; gives additional facts on dollar-saving installations. Free copy on request.

Here's an actual photograph that proves an important, profit-building point to users of ball mill equipment . . . *the real cost of liners and grates is the actual service cost.*

This Amsco grate has milled 193,797 tons . . . compared with just 113,000 tons for a previously used hardened steel grate which ran under identical conditions. And, during this period of 72% greater tonnage milled, *the Amsco grate required no down-time for repair.* The previously used grate started to crack at 50,000 tons—required many shutdowns for plugging holes.

Because of heavy impact, this particular Amsco Grate was made of austenitic chromium-manganese steel—one of three Amsco alloys developed for specific conditions of impact and/or abrasion. These Amsco liner and grate alloys can result in big savings on milling costs. Amsco Engineers are fully qualified to make alloy recommendations based on your operating conditions—*write today for the name of the Amsco engineer nearest you.*

AMERICAN Brake Shoe COMPANY

AMERICAN MANGANESE STEEL DIVISION
376 EAST 14th STREET • CHICAGO HEIGHTS, ILL.

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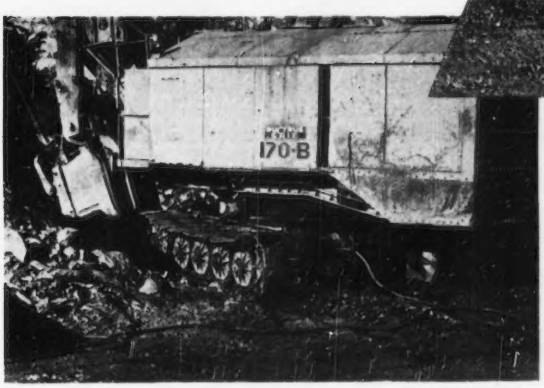
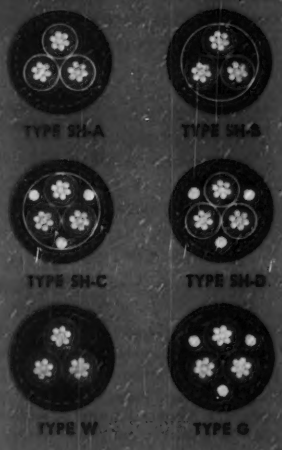
back up your shovels with

TOUGH, MOLD-CURED HAZACORD

IT'S A TOUGH LIFE that electric shovel cable has to face. That's why Hazacord Shovel Cable is specially designed and constructed with the extra strength and durability that pays off in this severe service. Take Hazacord's outside protection—the Hazaprene ZBF Sheath. It's a double-layer, reinforced sheath that's mold cured under pressure to form a dense, homogeneous wall with tire-tread toughness and resiliency. Compounded with neoprene, it's unaffected by oil, acids, water, and sunlight. Yet with all the life-extending toughness you get with Hazacord Shovel Cable, ample flexibility for easy handling is retained.





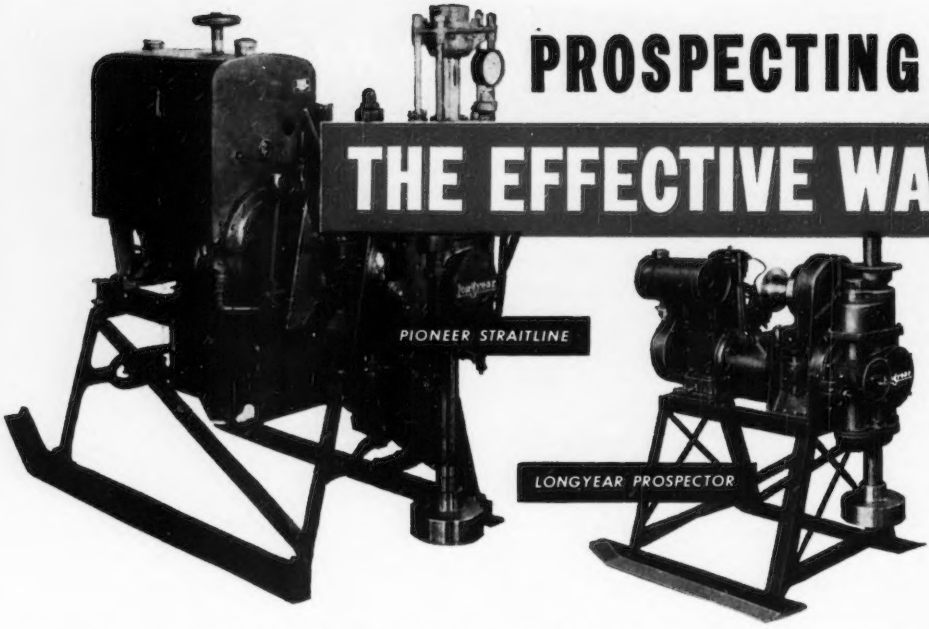
TO KEEP SHOVELS WORKING Hazacord is designed-for-the-job with many "inside" features as well that give you *extra protection* against cable failure. Long-lived, electrically stable, heat-resisting Performite insulates each conductor; permanently colored Okobestoprene Tape (a non-fibrous asbestos-neoprene material developed by Okonite) is precision wrapped around each insulated conductor. It seals into a flame- and moisture-resistant, non-rotting protective covering that also provides flexibility and permanent circuit identification. For moisture tightness at cable ends, and added cushioning qualities, Hazaprene fillers are used in conductor interstices instead of ordinary fibrous material.

For full information on Hazacord's many features that are delivering money-saving service to more and more operators—ask your Hazard representative to call, or write Hazard Insulated Wire Works, Division of The Okonite Company, Wilkes-Barre, Pa.

HAZARD insulated wires and cables for every mining use

PROSPECTING..

THE EFFECTIVE WAY



YOUR BEST METHOD is core drilling. A given area may be rapidly and economically tested, core samples recovered, mineral values determined . . . Cores tell the story!

YOUR BEST DRILLS for shallow to moderate depth drilling are the Longyear Prospector and Pioneer Straitline. Their practical advantages include:

- MOBILITY—Conveniently transported to remote districts by plane, or "broken-down" for pack horse or canoe. They are easy to move in the field.
- DEPENDABILITY—Design and sturdy construction assures continuous, trouble-free operation. That means more feet per shift.
- ECONOMY—Fuel consumption and operating costs are low. Reduced diamond loss results from smooth power-flow to bit.

YOUR CHOICE OF PROSPECTOR OR PIONEER DEPENDS ON DRILLING CAPACITY REQUIRED

DRILL CAPACITIES—The depth of holes to be drilled will govern largely the selection of your drill. The Longyear Prospector, capacity 300′ of ⅞″ core, and the Longyear Pioneer Straitline, capacity 600′ of ⅞″ core, are illustrated and fully described in bulletins No. 73 and No. 69 respectively. Write for them.

CORE DRILLS AND SUPPLIES—Longyear manufactures a complete line of core drills—large or small, for surface or underground use. There is a quality-built model to suit your job.

Also, quality-built diamond drill accessories and standard supplies are available from stock.

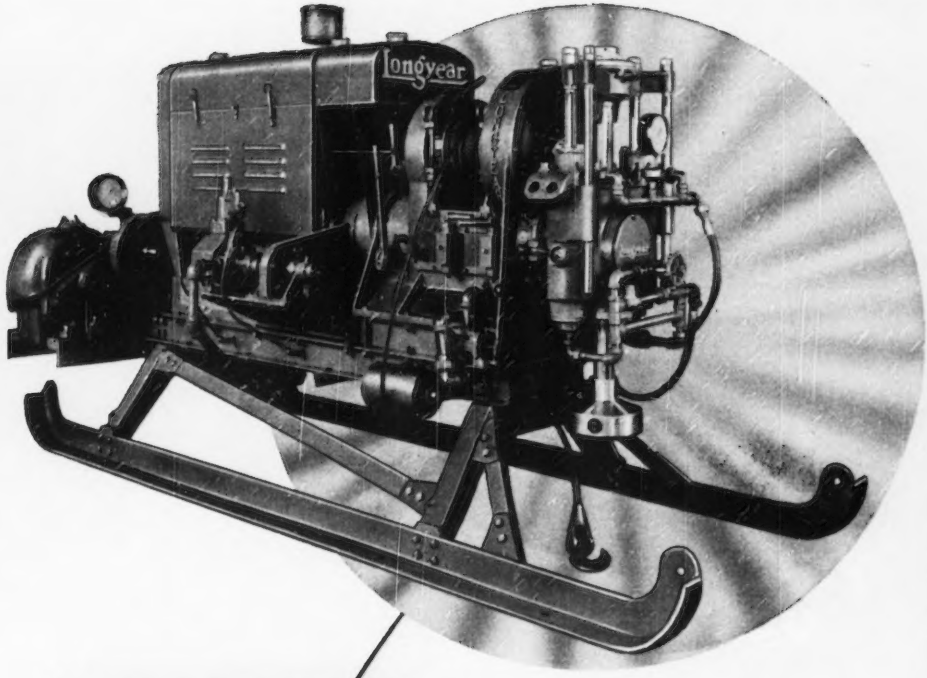
E. J. LONGYEAR COMPANY

MINNEAPOLIS, MINNESOTA, U.S.A. NEW YORK OFFICE, 1775 BROADWAY

CANADIAN LONGYEAR, LIMITED, NORTH BAY, ONTARIO, CANADA

DIAMOND CORE DRILLS • CONTRACT CORE DRILLING
SHAFT SINKING • GEOLOGICAL INVESTIGATIONS

REPRESENTATIVES IN PRINCIPAL MINING CENTERS IN THE UNITED STATES AND OTHER COUNTRIES



Christopher Columbus ...mining field version

bearings engineered by SKF

Straitline Diamond Core Drills, made by E. J. Longyear Company, Minneapolis, are doing yeoman service exploring metal and non-metallic deposits. They're also helping expand known ore bodies . . . determine drifting and raising . . . block out ore ahead of mining. They work hard and fast under extremely tough conditions . . . but they function efficiently day in day out because friction is kept at the minimum by SKF Bearings. The drilling head is equipped with two SKF Single Row Deep Groove Ball Bearings and a pair of SKF Angular Contact Bearings. Once again SKF has supplied bearings . . . expertly engineered and made right for the job. **SKF** INDUSTRIES, INC., PHILADELPHIA 32, PA., *the Pioneers of the Deep Groove Ball Bearing—Spherical Roller Bearing—Self-Aligning Ball Bearing.*

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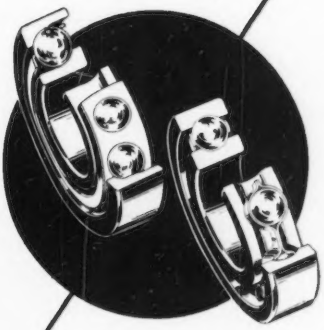

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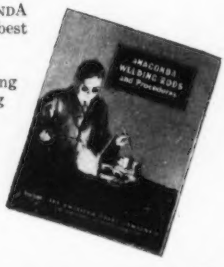

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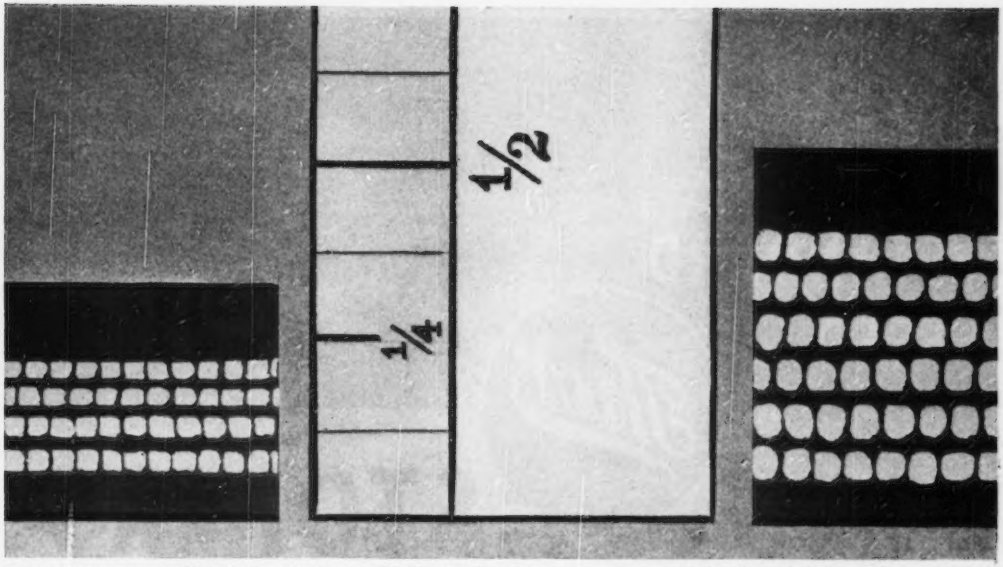

GREATER STRENGTH of belts built with "Cordura" is illustrated above (enlarged in scale to show detail of construction). At left is cross-section of four-ply belt sinewed with "Cordura." It's stronger than conventional six-ply belt at right, yet only half as thick. This thin, light belt is particularly desirable where panel equipment is moved frequently.

WILL YOUR NEXT CONVEYOR BELT HAVE THESE FEATURES?

Here are four operating advantages you can have built in your next conveyor belt simply by asking your supplier to build it on Du Pont Cordura* High Tenacity Rayon. This is the industrial yarn that gives strength to heavy-duty truck tires and lightweight high-pressure hose. And it makes a stronger and easier-to-operate belt . . . at no extra cost.

We will be glad to send you the names of suppliers of these efficient belts. You can also get full information about "Cordura" in the new manual "Sinews for Industry." It gives physical properties of "Cordura" rayon, describes many successful applications and tells how "Cordura" improves the efficiency of conveyor systems. For your free copy, address Room 4529, Rayon Division, E. I. du Pont de Nemours & Co. (Inc.), Wilmington 98, Delaware.

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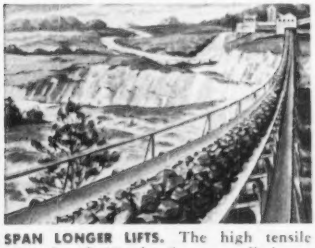
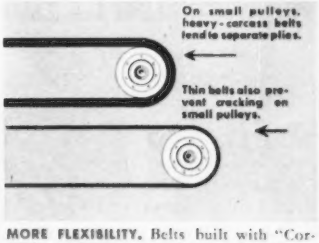


SPAN LONGER LIFTS. The high tensile strength of "Cordura" rayon eliminates costly transfer points. For example, a belt reinforced with seven plies of "Cordura" can lift 1000 tons of overburden per hour up a 15° slope over 1000-foot centers. It has design tension of 900 pounds per inch of width.



MORE FLEXIBILITY. Belts built with "Cordura" have less tendency to crack and separate plies when run over small pulleys required in confined working space. And belts built with "Cordura" have less stretch, so less take-up room is needed. And they trough well under any loading conditions.

HEAVIER LOADING CAPACITY is possible on conveyor belts built with Du Pont "Cordura" High Tenacity Rayon. This yarn is inherently stronger than the natural fibers commonly used. It packs extra strength into conveyor belts and enables them to carry loads to the capacity of power equipment.

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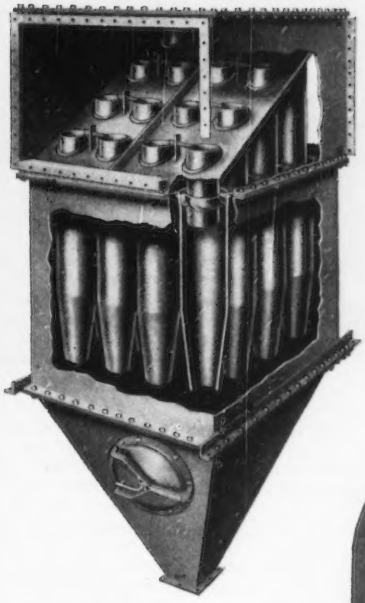

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No other mechanical recovery equipment has so many years of dust and fly ash recovery experience behind it . . . or has such uniformly high collecting efficiency . . . or provides so many other money-saving, space-saving advantages as MULTICLONE. The four advantages outlined below are by no means the complete MULTICLONE story, but are typical of the vital savings found *exclusively* in MULTICLONE equipment . . .

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Space-Saving Compactness:

Plant space costs money—so be sure to check space requirements carefully. As shown in the accompanying chart, the MULTICLONE requires less floor space and less cubic space than any other unit of comparable capacity and performance. Translate these savings into today's high costs for plant space and you readily see the great importance of this one MULTICLONE advantage alone!

Make	Relative Space Requirements In Sq. Ft.	In Cu. Ft.
Multiclone	1.0	1.0
Collector A	2.1	1.8
Collector B	5.9	3.2
Collector C	6.8	3.9

Long and narrow

Square

Maximum Adaptability:

In addition to its unusual compactness, the MULTICLONE is also unusually adaptable to various installation requirements. Where head room is low it can be installed with side-inlet side-outlet connections. Where side clearances are restricted, it can be installed with side-inlet top-outlet connections. In addition, without changing capacities, the shape of the unit can be varied—long and narrow, short and wide, or square—to fit restricted spaces . . . and its single-inlet single-outlet duct requirements permit greater flexibility and simpler installation. These savings slice installation costs, space requirements and insulating expense.

Minimum Maintenance:

The MULTICLONE has no high speed moving parts to repair or replace . . . no pads or filters to clean or renew . . . nothing to choke the gas flow or increase draft losses as suspended materials are recovered. MULTICLONE draft losses remain uniformly low *at all times*. Further, the recovered material from an entire bank of tubes is collected in a *single* hopper—far easier to service and maintain than the multiple hoppers of conventional cyclone units.

FREE INFORMATIVE BOOKLET

This 32 page booklet outlines the basic principles of centrifugal dust recovery and shows the many ways MULTICLONE advantages assure higher recovery at lower overall costs. A free copy of this booklet will gladly be sent on request. Write today!

Before you decide on any recovery equipment be sure to get complete information on MULTICLONE advantages. A letter, wire or phone call to our nearest office places this information in your hands without obligation. Get *all* the facts and you will get MULTICLONE Collectors!

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STD. SIZE	O.D.	I.D.	CALCULATED B.P. P.S.I.	WT. FT.	NORMAL SHIPPING LENGTHS
1/2"	0.840	0.622	540 lb.	0.103 lb.	400 ft. coils
3/4"	1.050	0.824	350 lb.	0.140 lb.	400 ft. coils
1"	1.310	1.070	200 lb.	0.181 lb.	300 ft. coils
1 1/4"	1.660	1.380	200 lb.	0.267 lb.	300 ft. coils
1 1/2"	1.900	1.610	200 lb.	0.320 lb.	250 ft. coils
2"	2.378	2.070	170 lb.	0.445 lb.	200 ft. coils
3"	3.504	3.070	165 lb.	0.91 lb.	100 ft. coils
4"	4.504	4.030	150 lb.	1.25 lb.	25 ft. str.
6"	6.630	6.070	115 lb.	2.23 lb.	25 ft. str.

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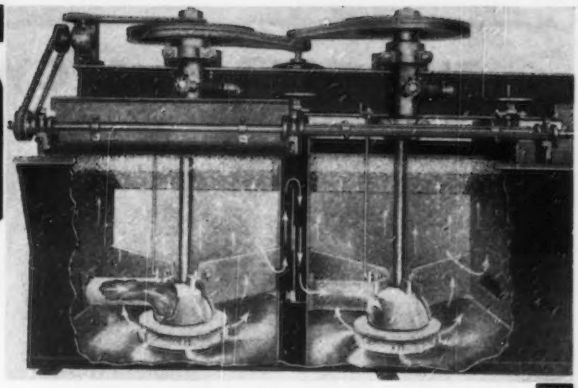

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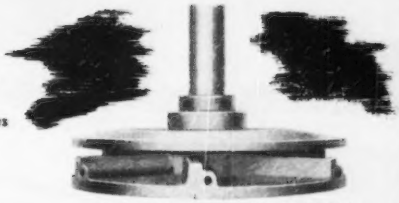

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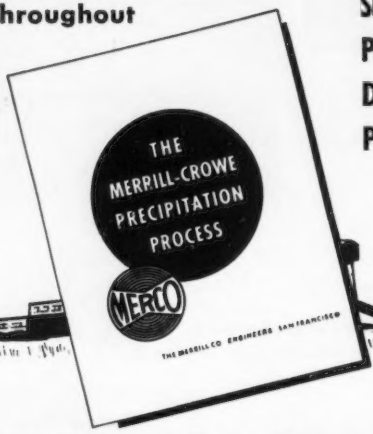

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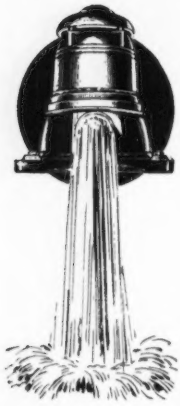

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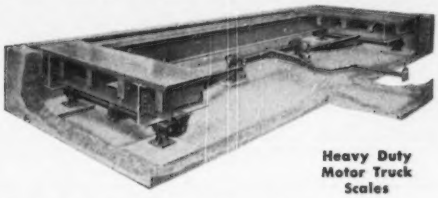

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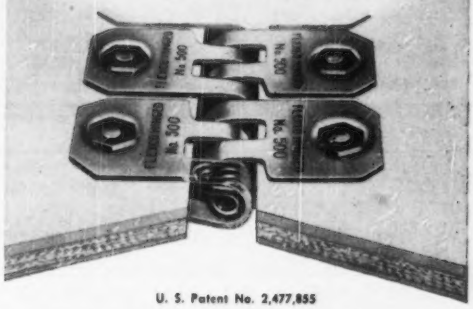

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Aurora Side Suction
Single Stage Centrifugal Pump.
Caps. to 1,400; Heads to 190 ft.

There is a Size and Type of PUMP "by Aurora" for EVERY Pumping Need In INDUSTRY

You may count on perfect performance with lasting efficiency when you rely upon this Aurora Type GGU for either important or incidental liquids handling in industrial processing. The casing is separate from the bearing bracket, THEREFORE, the need for special metals to handle corrosives is minimized. Discharge may be placed in any of eight positions. We commend these pumps for high satisfaction and economy.

Ask for CONDENSED CATALOG "M"

APCO TURBINE-TYPE PUMPS

For high pressure, small capacity requirements up to 150 g.p.m. Wide operating range characteristics. No metal-to-metal contact. Handles non-lubricating liquids without wear. Only one moving part — the impeller.

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POSITIONS AVAILABLE

Required for a new Electrolyte Copper Refinery, men who have had previous copper refining experience. Positions available are: Assistant Superintendent, General Foreman and Assistant General Foreman in the Tank house and Electrolyte Purification section. Assistant General Foreman in the Precious Metal and By-Products department and various under foremen for not only these departments, but the Copper Casting section as well. In addition, employment is available for men experienced in sampling, inspection, and laboratory methods used in Copper refineries. The plant is being erected in the Rocky Mountain area.

Complete details regarding past employment record together with references, personal data, etc., to be furnished with applicant's first reply. Salary will be determined by experience and record of the individual. All correspondence will be considered absolutely confidential.

P6014, Engineering & Mining Journal, 68 Post St., San Francisco 4, Calif.

SEARCHLIGHT SECTION

(Continued on pages 174-177)

REPLIES (Box No.): Address to office nearest you
NEW YORK: 330 W. 42nd St. (18)
CHICAGO: 520 N. Michigan Ave. (11)
SAN FRANCISCO: 68 Post St. (4)

POSITIONS VACANT

WANTED—MANUFACTURERS' Agent: Eastern manufacturer of mining equipment (skips, cages, sheaves, hoists, rotary dumps, material handling equipment) serving the Eastern and Southeastern coal, salt and zinc mines for 43 years now desires an aggressive agent in the Western mining fields. Write stating area for which exclusive agency is desired. P-6216, Engineering & Mining Journal.

SELLING OPPORTUNITY OFFERED

MACHINERY FIRM operating West Coast South America has opening for Sales Engineer familiar with Mining and Milling machinery. General sales and service. Preferably graduate engineer with sales ability. Advise age, marital status, experience. Spanish advantageous but not essential. Reply SW 6511, Engineering & Mining Jl.

POSITIONS WANTED

MECHANICAL SUPERINTENDENT. Twenty-five years experience with erection, operation and maintenance of heavy industrial construction and mining equipment. Past six years on Latin American Operations. Speak Spanish fluently. Will go anywhere. Immediately available. PW-6299, Engineering & Mining Journal.

MINING ACCOUNTANT auditor. Three years CPA experience, approximately 10 years mining, oil, lumber Spanish speaking countries, Walton training, fluent Spanish, fair French, excellent health, acclimatized tropics. Temporary or permanent assignment. PW 6593, Engineering & Mining Jl.

POSITIONS WANTED

SUPERINTENDENT FOREMAN 14 years experience—excavating—grading—tunnels—highways—railroad construction. Reinforced concrete pours—placements. Mass and slab work. A-1 references. Go anyplace. PW 6558, Engineering & Mining Jl.

MILL SUPERINTENDENT. M.S. 30 years experience operation and maintenance of Flotation and Amalgamation Plants. Design and Construction. Flotation Research. Single. Any western U. S. location. Available 30 days' notice. Reply PW 6597, Engineering & Mining Jl.

MINING EXECUTIVE. E.M. (Geology). Degree in 1919. Speak Spanish. No preference as to location. Ten years experience as mining geologist. Twenty years experience in supervisory positions with large mining company in South America. Successful in labor relations. Excellent references. PW 6625, Engineering & Mining Jl.

MILL SUPERINTENDENT. Metallurgical Engineer, 43. Single. Testing, design, construction and operation. Cyanidation of refractory Gold ores. Selective flotation of Gold, Copper, Lead and Pyritic ores. Extensive experience primary slime problems. Ten years Latin America and Orient. Especially skilled training of foreign engineers for supervisory work. Skilled in handling and training of low grade labor. Fluent Spanish. Accustomed to tropical living, isolated camps. Prefer Latin America. Presently employed. Available September 1st. PW 6630, Engineering & Mining Jl.

METALLURGIST: DEVELOPMENT and research experience smelting and refining nonferrous metals; application of furnace, electrolytic, and leaching methods to production of copper, silver, cadmium, tin, lead, etc., from ores slags, residues. Also worked on metal powders. PW 6446, Engineering & Mining Jl.

POSITIONS WANTED

MINING GEOLOGIST, recent graduate, experience western U. S., age 25, single, good health. Now temporarily employed, available short notice. Location open. PW 6776, Engineering & Mining Jl.

MINE SUPERINTENDENT—Mining Geologist, eighteen years mine operation and mine examinations, desires employment in the metal mining field. Single status, excellent health, will consider any location. Available thirty days. PW 6448, Engineering & Mining Jl.

METALLURGIST-MILL Superintendent available with the necessary experience, the necessary academic training and competent references. PW 6643, Engineering & Mining Jl.

DREDGE-OR MILL Superintendent. Member A.I.M.E. 39 years old, married, no children. Large experience dredging, flotation, gravity, and sink float plants. Fluent Spanish. Available after August 1. PW 6716, Engineering & Mining Jl.

BUSINESS OPPORTUNITIES

Large deposit gypsum

recently uncovered three hundred feet thick, extending more than a mile, three hundred yards from railroad, power line on property. Owner incapacitated, want help from financially responsible people, this is greatest opportunity of recent years, a great industry will spring up here. BO 6478, Engineering & Mining Jl.

For Sale—55 mining claims.

11,850 gt. cross-cuts and drifts, 29 addits, 3 raises, 1,800 gt., 1 incline, 250 ft.; Federal Power rights and timber for mining; 2 million tons blocked out gold ore. Utility Mining Co. —P.O. Box 313, Everett, Wash.

Two huge Diatomite

deposits. E. N. Bennett, Payette, Idaho.

Additional Employment & Opportunity Advertising on Page 174.

SEARCHLIGHT SECTION

EMPLOYMENT • BUSINESS • **OPPORTUNITIES** • EQUIPMENT—USED or RESALE

UNDISPLAYED RATE:
Not available for equipment advertising
$1.20 a line, minimum 4 lines.
To figure advance payment count 5 average words as a line.
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The advertising rate is $9.75 per inch for all advertising appearing on other than a contract basis. Contract rates quoted on request.

AN ADVERTISING INCH is measured ⅞ inch vertically on one column, 3 columns—30 inches—to a page. E.M.J.

NEW ADVERTISEMENTS received by 10 A.M. June 21st, at the New York office, 330 W. 42nd St., N. Y. 18, N. Y., will appear in the issue of July subject to limitations of space available.

STAFF POSITIONS OPEN FOREIGN SERVICE

SAFETY AND VENTILATION ENGINEER: middle aged, experienced in large underground mines, technical background.

METALLURGIST: relatively young; some actual practical experience in ore beneficiation essential; aptitude research work most important. Single status.

SUPERINTENDENT: take charge small sulfuric acid plant; pyrite roasting; in connection with copper leaching plant. Broad chemical knowledge necessary. Good academic background and practical experience.

Permanent well-established company. Engagement three-year contract; vacations generous; housing, utilities furnished; traveling paid. Applicants state fully education, experience; age; physical condition; family status. References and salaries at previous employment. Submit photograph. All salaries open.

P 6673 Engineering & Mining Journal
621 S. Hope St., Los Angeles 14, Calif.

WANTED
SIGNIFICANT NEW MACHINE DEVELOPMENTS

Our client, a nationally known manufacturer of high grade heavy machines, is in position to undertake the development of new and promising ideas looking to the manufacture of additional lines of machinery.

Please write Dept. 5; enclose copy of this ad; give full description.

We are compensated by our client.

CHARLES H. WELLING & CO., INC.
52 Vanderbilt Ave. New York 17

Consultants in new products and diversification

RAILS-TIES
TRACK ACCESSORIES

RELAYING RAIL
All Sizes
Track Accessories
LEFTON INDUSTRIAL CORP.
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New **RAILS** Relay
Track Accessories — Steel Storage Tanks
W. H. DYER CO., INC.
1859-J Railway Exchange Bldg., St. Louis, Mo.
Operating Nationally

SURVEYING INSTRUMENTS
USED • REBUILT • SALE
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It costs no more
to have your instruments of any make
repaired by the makers of the
WORLD'S FINEST SURVEYING INSTRUMENTS
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OPEN PIT MINING

Contractor with excellent equipment and experienced personnel interested in excavating, material handling, or open pit mining work.

CW1319—Engineering & Mining Journal
330 W. 42nd St., New York 18, N. Y.

LEASER WANTED

Silver mine "Anexas a Florencia" in Sabinal, Chihuahua, Mexico, for lease on royalty basis. Closed in 1929 during revolution. Inactive due to lack of operating capital. For further information contact:

S. Caraveo
Morelos 2219, Chihuahua, Chih., Mexico

WANTED

BUYERS OF SURPLUS COPPER, INSULATED WIRES AND CABLES
No lengths too long or too short
Telephone: EAstgate 7-4778
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BUSINESS OPPORTUNITY

Experienced geologist seeks capital backing for application of new and technically sound technique of mineral prospecting. For details write

BO 6724, Engineering & Mining Journal
330 W. 42nd St., New York 18, N. Y.

COPPER AND SILVER MINE

94 pounds of COPPER to the ton and 6 oz. in SILVER at 10 ft. depth. Vein 10 ft. wide. A natural for mining. Water and timber. Very accessible. Will sell CONTROLLING INTEREST for $35,000 Cash. PRINCIPALS ONLY.

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If you have any metallurgical or chemical by-product sludges which may contain rare or minor metals, please contact:
Metallurgical Process Division
Saratoga Laboratories, Inc.
Saratoga Springs, New York
Sludges bought outright or recovery processes developed under contract.

WANTED

Large engineering firm wishes to acquire several complete plants through purchase of (1) capital stock, (2) assets, (3) machinery and equipment whole or in part. Personnel retained where possible, strictest confidence.

Box 1231, 1474 Broadway, New York 18, N. Y.

LEASER WANTED

Gold mine "El Rosario" and "El Triumfo" in Inde, Durango, Mexico, for lease on royalty basis. Inactive due to lack of operating capital. Previously owned by British concern. For further information contact:

S. Caraveo
Morelos 2219, Chihuahua, Chih., Mexico

DEPENDABLE EQUIPMENT AT A SAVINGS IN TIME AND COST

LOCOMOTIVES

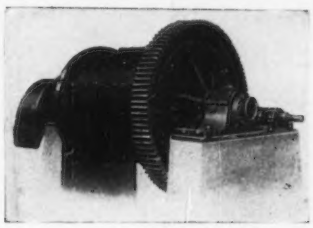
2—1½ ton Mancha "Little Trammer" battery, 18"-24" gauge.
2—2½ ton Mancha battery, 18"-24" gauge.
1—2½ ton Whitcomb battery, 24" gauge.
2—5 ton Westinghouse battery, 24"-36" ga.
2—7 ton General Electric battery, permissible type, 36" gauge.
2—8 ton General Electric battery, 36" ga.
4—10 ton Atlas battery, 36" ga.
3—6½ ton General Electric trolleys, 36" ga.
2—18 ton Davenport steam locomotives, 1—18" and 1 standard gauge.
1—3 ton Whitcomb gas engine driven, 24" gauge.
1—3 ton Ruth gas engine driven, 18" ga.
1—5"x16" Porter compressed air, 18" ga.
1—5½"x16" Baldwin compressed air, 30" ga.

LOADERS AND CONVEYORS

1—GD-9 Gardner-Denver rocker shovel loader.
1—#20 Elmco rocker shovel loader.
4—#50A Goodman Conway muckers.
2—#50A Goodman Conway muckers.
2—35' Chicago portable loader-conveyors, 14½" flights.
1—14'4" Northern portable loader-conveyor, 15" flights, powered by 5 HP Wisconsin gas engine.
1—18' Farquhar portable loader-conveyor, 18" width, powered by 4 HP Briggs & Stratton gas engine.

MISCELLANEOUS EQUIPMENT

1—27" x 14" McFarlane crushing rolls.
1—3' x 5' Tyler "Hummer" vibrating screen.
8—37½ KVA new Gregory transformers, 7200/12470Y to 120/240.
1—#20 Irvington heavy duty cut-off saw.
4—8' x 8' Devereux type agitators.
4—10' x 10' Devereux type agitators.
1—36" x 20' Dorr duplex classifier.
1—24" x 26" Jeffrey flextooth coal crusher.
1—3' Symons cone crusher.
1—4R-40 Ingersoll-Rand drill sharpener.
1—D8800 Caterpillar diesel engine with clutch.
1—36" Alsday centrifugal gold separator, type C.



BALL AND ROD MILLS

1—30" x 24" New Morse Bros. Batch Mill.
1—4' x 4' Standard Ball Mill.
2—6' x 36" Hardinge Conical Ball Mills.
1—6' x 48" Hardinge Conical Ball Mill.
1—6' x 8' Marcy Ball Mill.
1—8' x 22" Hardinge Conical Pebble Mill.
1—3' x 8' Denver Eng. Works Tube Mill.
1—3' x 9' Ruth Rod Mill.
1—5' x 36" Hardinge Conical Ball Mill.
1—64½ Marcy Ball Mill.
2—8' x 60" Hardinge Conical Pebble Mills, Silex lined.

FILTERS

1—3' x 2' Morse All Metal Drum Filter.
1—3' x 4' Oliver Drum Filter.
1—4' x 3' Disc Morse Filter.
2—6' x 2' Disc American Filters.
1—6' x 3' Disc American Filter.

JAW CRUSHERS

3—4" x 6" New Morse Jaw Crushers.
2—8" x 8" Universal Semi-Steel Crushers.
1—8" x 12" Universal Semi-Steel Crusher.
1—8" x 24" Rogers Cast Steel Crusher.
1—9" x 15" Farrell Blake Type.
1—9" x 16" Cedar Rapids All-Steel Crusher.
1—9" x 16" New Morse Crusher.
1—9" x 21" Telsmith Jaw Crushers.
1—8" x 36" Universal All-Steel Crusher.
1—9" x 36" Cedar Rapids.
1—15" x 20" Universal All-Steel Crusher.
1—10" x 24" Allis-Chalmers Jaw Crusher.
1—15" x 28" Pacific All Steel Crusher.

TUGGER HOISTS

5—I.R. Utility Air Hoists, Single Drum, 3 Model EU, 2 Model HU.
1—I.R. Size A-4NN-OJ2 Drum Air Hoist.
1—Sullivan RH 5 11P Single Drum Electric Slusher Hoist.
1—Sullivan RH 7½ HP Single Drum Electric Slusher Hoist.
2—I.R. Size 107, 7½ HP Single Drum Electric Slusher Hoist.
1—I.R. Size 5NN-OH 5 HP double drum electric slusher hoist.
1—I.R. Size 2B-MNM-2D 20 HP Three Drum Electric Slusher Hoist.
1—Sullivan Model B-211 25 HP Double Drum Electric Slusher Hoist.
3—Sullivan Type HE 6½ HP D.C. Single Drum Electric Hoists.
9—Sullivan Type HDE6½ HP D.C. Double Drum Electric Hoists.

REDWOOD TANKS

We carry a large stock of air dried redwood lumber and can make up any size tank to order.

BETTER MACHINERY—IT'S FULLY RECONDITIONED

ESTABLISHED 1898

MORSE BROS. MACHINERY CO.

P.O. BOX 1708 DENVER, COLORADO, U.S.A. CABLE "MORSE

COMPLETE ORE-MILLING PLANTS · CONCENTRATION · FLOTATION · MACHINERY · CYANIDE · AMALGAMATION

General Office and Plant: 2900 BRIGHTON BLVD., DENVER, COLO.

LOCOMOTIVE: 15 ton, gas, standard gauge automatic couplers.

CARS: 20—Easton 8 yd. Phoenix type, quarry cars, standard gauge.

BELT CONVEYOR: 2800 ft. La-Del, 36" all steel, roller bearing equipped, complete with belt and drive; new 1947, slightly used.

COMPRESSORS: 1—500 H.P. and 1—600 H.P., direct connected, two stage, 3 phase, 60 cycle, 220-440 volt.

BALL MILLS: Hardinge 8'x30" manganese lined, with or without 100 H.P. motor and drive; 5'x22" manganese steel lined with motor and feeder; 6'x36" silex lined; 8'x20" without lining; 7'x9' Ball Mill, steel lined with 250 H.P., 2200 volt motor.

AIR SEPARATOR: Gayco 14 ft. with motor and drive, NEW condition.

MINE HOISTS: 1—All steel drum 8 ft dia., 1½" rope, 64 000 lbs. single line pull, 600 FPM, 400 H.P., 2200 volt, A.C., located California. Condition like NEW. Other Hoists, single and double drum, 150 H.P. to 2500 H.P., all complete.

TRUCKS: Euclid 15 ton capacity, model FD-27, Cummins diesel, built 1945.

STEEL DERRICKS: 1—75 ton Stiff Leg, 100 ft. boom. 1—35 ton Guy, 88 ft. boom. All complete.

A. J. O'NEILL
LANSDOWNE, PA.
Phila. Phones: Madison 3-8300—3-8301

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COMPLETE WITH SWITCHBOARDS
1000 KW to 100 KW
STATIONARY and PORTABLE
AT GREATLY REDUCED PRICES
NEW UNIT GUARANTEE

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Bought and Sold New and Rebuilt
ELECTRIC EQUIPMENT CO.
ROCHESTER 1, N. Y.

Rotary Kilns—6½' x 70' & smaller. One 9' x 170'.
Rotary Dryers—3' x 30'—4' x 30'—6' x 40'—5½' x 50'—6½' x 60'—8' x 70'—7' x 60'.
Tube & Ball Mills—6' x 9'—5' x 22'—5½' x 18-7".
Fuller-Lehigh Mills—22"—47" & 52"—Bradley Mills.
Jaw Crushers—From 10" x 6" up to 38" x 24".
Crushing Rolls—From 16" x 10" up to 72" x 20".
1—7" Newhouse Crusher, latest type.
Sturtevant Rotary fine crushers—No. 0—No. 1—No. 1½ and No. 2.
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15'—16' & 18' Herreshoff furnaces.
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8'—14' air separators.
Magnetic separators—jigs—screens—classifiers and thickeners.
5', 6' & 7' dia. Rod Mills.
Mine Hoists.
One 4 roll Raymond Mill, low side.
8' x 10'—8' x 12'—11½' x 19' Rotary Filters.

W. P. HEINEKEN
227 Fulton St., N. Y.

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10 to 1000 H. P.
NEW-USED
RECONDITIONED
Steam, Gas and Electric Power Equipment

J. PARKER THOMPSON CO., INC.
507 FIFTH AVE., NEW YORK CITY
MURRAY HILL 7-6547-8-9

CLASSIFIERS

1—60" x 23' Denver Equip. Simplex Cross-Flow Classifier, with Gear Motor.
1—6' x 22' Dorr Type Duplex Rake Classifier.

BELT CONVEYORS

1—14", 20' Centers, new belt, V-belted to 1½ HP Motor.
1—24", 15' centers, Motorized.
1—42", 20' centers, Motorized.
1—30", 40' centers, with Mechanism & Motor.

FILTERS, DISC

1—4', 6-disc, Elmco, with Vacuum Equipment.

FLOTATION MACHINES

2—#24 Denver "Sub-A" 8-cell, Wood Tanks.

GENERATORS

1—D-4400 Caterpillar Diesel Power Unit, V-belted to 30 KVA 220 volt AC Generator.
1—96 KW G.E. 2300 volt AC Generator direct connected to a 14 x 17 Corliss Engine.
1—3½ KW Chandeason Generator, 53 volts AC, direct connected to 5 HP AC Motor.
1—15 KVA Ft. Wayne AC Generator, B.D.

CONCENTRATING TABLES

4—6' x 16' Deister Type, with new Rubber Deck Covering, Riffles & Motors.
2—6' x 16' Butchart, with new Rubber Deck Covering, Riffles & Motors.

PUMPS

6—2" Wilfley Sand Pumps.
2—3 x 4¼ Goulds Pyramid.
2—8" Hydroseal Pumps.
1—8" Hydroseal Pump.
Ingersoll-Rand Motor Mtd. Pumps.
Peerless Deep Well Pumps.

SCREENS

1—4' x 8' Hum-mer Tandem Sgl. Surface Screen.
1—20" x 6' Trommel Screen.
1—30" x 15' Trommel Screen.
1—48" x 8' Trommel Screen.
1—48" x 16' Revolving Screen.

MISCELLANEOUS

Good Used Reconditioned Rock Drills.
Gardner-Denver 1 pt. Line Oilers.
Motors—AC & DC.
1—Dings Type MM Magnetic Separator.
50-Tons 85# Relayers.

WRITE FOR OUR COMPLETE STOCK LIST NO. 10

FLORENCE MACHINERY AND SUPPLY CO.

904 Equitable Bldg. **Denver 2, Colorado**

FOR SALE

1—Pair Allis-Chalmers "Anaconda" Crushing Rolls, 40" x 15". Completely rebuilt and rehabbitted.
1—Kent Maxecon, Type 27, Ring Roll Mill & Drive.
1—Sturtevant, No. 2, Ring Roll Mill & Drive.
1—24" x 20" Type B Jeffrey Hammermill.

JOHNSON & HOEHLER, INC.
P. O. Box 102 **Lansdowne, Pa.**

FOR SALE

AC-DIESEL ENGINE-GENERATORS
PRACTICALLY NEW

9—100 KW 3/60/460 WORTHINGTON DIESEL MODEL BB5
Price $5000.00 each, f.o.b. Trenton

3—150 KW3/60/460 BUCKEYE DIESEL MODEL 80
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All with Westinghouse Generators, *Complete* with Exciters, Cooling Systems, Starting Equipment, Switchboard, Silencers, etc.

Subject to Prior Sale

EASTERN SCRAP & SALVAGE CORP.
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DIESEL ENGINES FOR SALE

2 VENN-SEVERIN 75 HP. DIESEL ENGINES, 400 RPM, Mfg. in 1938, belted connected to 60 KVA General Electric 3 phase, 50/60 cycle, 220 volt alternators.
Price .....$1,500.00 Ea.

CAN BE INSPECTED ON ORIGINAL FOUNDATION UNDER POWER

EXCELLENT CONDITION

A. J. WINSTON
517 SOUTH DELAWARE ST.
INDIANAPOLIS 4, INDIANA

One 7' x 16' Marcy Open End Rod Mill. Complete with 200 H.P. 900 RPM Electric Machinery Synchronous Motor, Falk #11 HA 6.94: 1 Speed Reducer and Auto. Starting Equipment.

In good operating condition — must be moved quickly to make room for other equipment.

FS6301, Engineering & Mining Journal, 520 N. Michigan Ave., Chicago 11, Ill.

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NEW AND REBUILT

Save 40% to 60%

ALL MAKES — ALL SIZES
STATIONARY OR PORTABLE
GAS — DIESEL — STEAM — ELECTRIC

RENTAL
273 AIR COMPRESSORS AVAILABLE
RENTAL PURCHASE
GAS — DIESEL — ELECTRIC

AMERICAN AIR COMPRESSOR CORP.
47th & Dell Ave,, North Bergen, N. J.

HOISTS—COMPRESSORS —BALL MILLS

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16″	4	1/8″	1/32″	28 Oz.
18″	4	1/8″	1/32″	28 Oz.
20″	4	1/8″	1/32″	28 Oz.
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24″	4	1/8″	1/32″	28 Oz.
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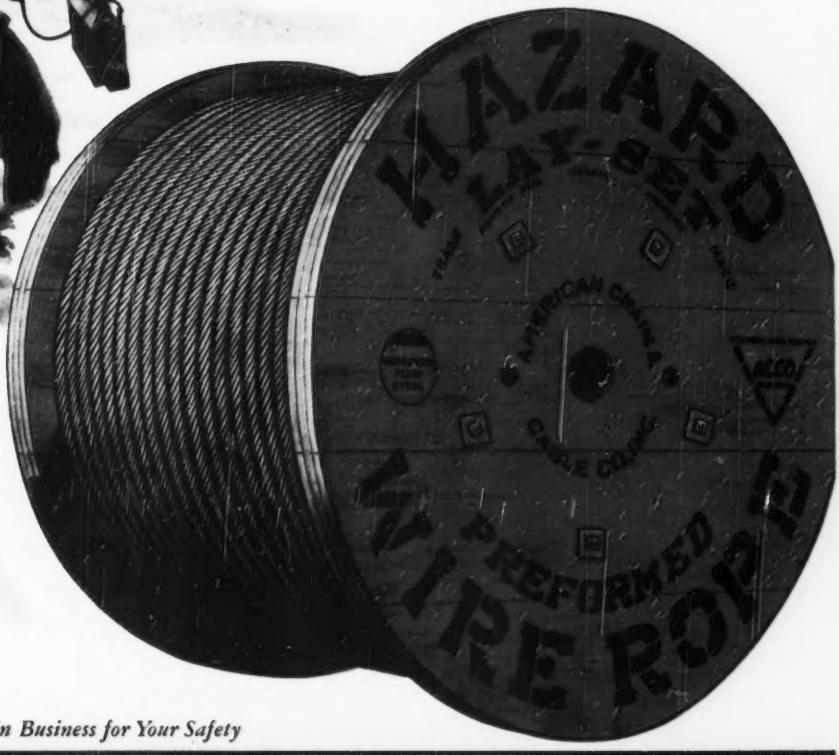

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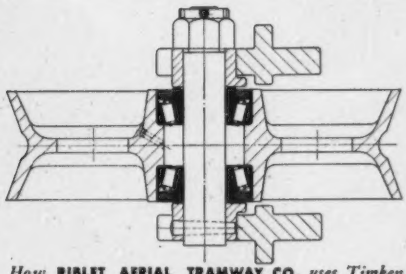

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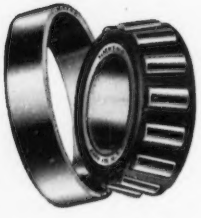

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